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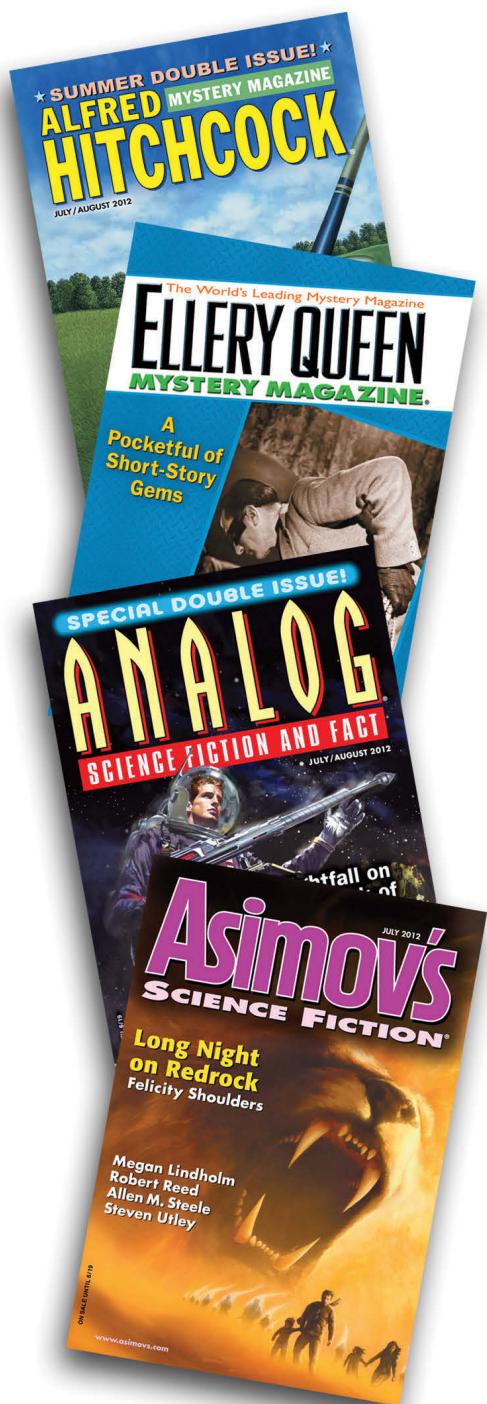
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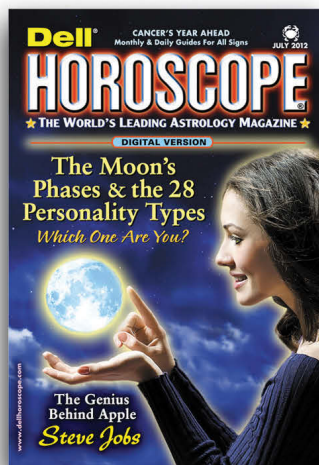
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SCIENCE FICTION AND FACT

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SNEAK INVASION, REVISITED

The recent hype surrounding the announcement of the highly anticipated Apple Watch reminded me of an editorial that John W. Campbell wrote in the November 1942 issue of *Astounding*. Titled “Sneak Invasion,” the article’s main thrust was that practical technological improvements are rarely gigantic leaps forward, and they rarely take us by surprise. As Campbell wrote,

The new techniques filter into normal life so smoothly, in such small steps, with so much forewarning, that they never surprise us. No company manufactures new devices until they’ve prepared the public to receive them and use them.

One can almost imagine that Campbell had Apple in mind with a statement like this, but his point applies to many forms of technology from automobile manufacturers and drug companies, to computer companies and online software services.

The main point that Campbell makes is that these improvements tend to be incremental in nature and therefore sneak into our lives through a gradual progression of small advancements. Such a sneak invasion of technology is made easier because the rumor mill ensures the public is prepared for it when it arrives. Campbell likely wrote this editorial sometime early in 1942, which means that what Apple, Google, Ford, and other companies have been doing in this respect—feeding the rumor mill—is nothing new to the process. Only the methods of delivery have changed.

As a science fiction fan and writer, I find the incremental nature of technological

change fascinating, in large part because it builds upon itself so quickly. Distant, imagined futures often seem strange to us because we’ve skipped over the incremental changes, and have been dumped into that future. We become literary time travelers.

Consider that Campbell’s editorial was written 72 years ago, not long after the United States entered World War II. How were the science fiction writers of the day imaging the future? The first stories making up Isaac Asimov’s *Foundation* series appeared in 1942. These are far future stories with flying cars and self-driving taxis. The stories refer to “book films,” and, of course, an *Encyclopedia Galactica*, a centralized, curated repository of all human knowledge.

Lester del Rey’s “Lunar Landing” appeared in October 1942, and typifies stories of “first attempts” to land humans on the Moon. In many stories like these, you get the sense that the authors felt humanity was less than a generation from permanent colonies on the Moon and Mars. A particularly imaginative writer like C. L. Moore might ponder the implications of the multiverse, as she did in her wonderful 1939 story, “Greater Than Gods,” and Robert Heinlein made an attempt to portray a post-singularity future in his serial, “Beyond This Horizon,” but both of the stories were outliers.

We wonder, scornfully, where our flying cars, jetpacks, and food pills are, but in fact, those were just some of the technological improvements that science fiction writers seven decades ago believed were not far off in their future.

Yet imagine a young science fiction writer from 1942 drawn 72 years into the future, perhaps by a lightning bolt, like Martin Padway in L. Sprague de Camp’s classic *Lest*

Darkness Fall. Would the small, steady accumulation of technological changes that sneak in over time make for a recognizable future for that dislocated soul?

Context plays a role, and given the focus of technology in the early 1940s, I think our imagined time traveler would be disappointed. Microwave ovens might seem like a nifty invention, but where are all of the atomic powered cars? Atomic powered airplanes? Atomic powered lawn mowers and vacuum cleaners? We could, with pride, tell our science fiction-writing friend that not one, but twelve men once stood on the Moon.

The natural response to the statement might be, “And how many are up there now?” Sadly, we would have to admit that no one is on the Moon now. We have robots roaming Mars, and a probe due to arrive in the vicinity of Pluto (which, by the way, is no longer a planet—long story) later this year. But no one has set foot on the Moon in 42 years.

However, we *do* have a kind of *Encyclopaedia Galactica*. We call it the internet, and it isn’t really curated, and you have to take what you see there with a grain of salt. And for goodness sake, whatever you do, don’t read the comments.

Our time-traveling science fiction writer might be disappointed that we don’t have atomic powered cars, or permanent Moon bases, but things like the internet might truly baffle them. Things like a word processor might baffle them, for that matter. The evolution from typewriter to modern word processor is a good example of what Campbell was referring to. As someone who started writing on a typewriter (my grandfather’s manual Royal QuietComfort DeLuxe) and who now

does all of his writing in Google Docs, the change has been very steady.

But imagine our science fiction writer, skipping seven decades of small, but steady advancements. The keyboard is mostly the same. But where is the paper? How do the words on the screen get to the paper? Where do they go in the meantime? And why does it keep trying to correct my spelling?

Our time traveler probably listened to Bing Crosby’s “Far Away Places” on a radio or phonograph. He or she went to the movie house (as my grandfather used to say) to see *Road to Morocco*, and watched their favorite TV shows on—oh, wait, they probably weren’t watching television in 1942. What would our time-traveling friend think of an iPhone, on which I can carry my entire music collection (including nearly two hundred Bing Crosby tunes); from which I have access to thousands of movies virtually instantaneously; and from which I can download and watch seasons of just about any television show aired in the last half century.

Our time traveler probably walked to a nearby newsstand to pick up the latest issue of *Astounding*, and the other science fiction magazines of the day. What would they think when told that issues of all of my favorite science fiction magazines are downloaded to my Kindle device, or my iPad, or iPhone each month? Would it seem like science fiction to them?

Certainly our time traveler would recognize the bookshelves that line the walls of my living room, and probably many of the books and magazines on those shelves. But what would they think when told that most of my books are in digital form, and reside within a “cloud” made up of millions of computers

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connected together? Would they be aghast at the blasphemy toward books as a physical object? Or would they see it for the very science fictional future imagined in the stories that appeared back in their day?

We can see some of this change ourselves. A quarter century ago, when I headed off to college, I took with me an IBM computer with an Intel 286 processor. I used WordPerfect to type up my term papers, but did nearly everything else by hand. I took notes with a pen and paper. My textbooks added fifty pounds to my cross-campus hikes. When I did my homework, I listened to the radio, and when I needed entertainment, I went to the second-run movie theater on campus.

Today, I live in a world where my laptop computer is thinner than the November 1942 issue of *Astounding* in which Campbell's editorial appeared. Sitting with my kids on a video chat with their grandparents is a more regular occurrence than a phone call. My subscriptions to *Scientific American*, *New Scientist*, and yes, even *Analog* are all digital. I can access any document I need from just about

any device I own within seconds. Even when flying across the country, I have internet access on the plane, and can carry my entire book, movie, and music library in my pocket.

At no time during the last quarter century did any of these changes manifest themselves as huge jumps in technology. The single biggest leap was from my old cell phone to my first iPhone, and Apple prepared me for it well in advance. Everything else took the form of small, incremental changes. And yet the world in which I live today, the world in which I work both as a software developer and a writer, is, technologically, leaps and bounds ahead of the world I lived in when I entered college.

Campbell's 1942 observation was keen and prescient, and naturally, leads me to wonder what the sneak invasion of technology will lead to over the next twenty-five years . . . and beyond. The best part of science fiction, for me, is exploring those possibilities, testing the waters, and in the process, stretching my imagination. ■

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Tasha's Fail-Safe

Adam-Troy Castro

Tasha Coombs:

As Tasha fled for her life, clutching the seeping wound in her side, she knew it was her own fault that she was probably going to die tonight.

Heading home that evening had, it turned out, been a serious tactical error. Strictly speaking, she should have stayed within the Intelligence complex and sought what sleep she needed in one of the several perfectly acceptable apartments the corps maintained in the heart of its own complex for people who had worked so late that it made no sense to go all the way home.

Besides, her assignment was about to go critical, and the hub-based sun had dimmed to provide New London with the equivalent of night. That meant there were fewer people on the streets and more opportunities for an ambush if she had not covered herself as conscientiously as she believed.

Really, going home to her own bed and to her virtual husband made a lot less sense than sticking around the job in case the flares went up.

She was too good to make that kind of mistake. She'd walked in and out of war zones.

She'd taken lives in order to preserve her own. She knew better.

But that was also the way she'd been living for almost three weeks now, as her investigation entered its final stages. None of her prior precautions had turned out to be necessary, and the operation hadn't quite passed the necessary tipping point so she made a decision that she now knew she never should have made: comfort over safety, stubbornness over self-preservation, the hunger for some kind of life over the imperative to preserve what life she had.

This was a mistake.

With her likely murderer's footsteps not far behind, she knew that it had been a mistake.

Earlier:

She had spent the last few weeks at the Dip Corps headquarters, at the heart of the cylinder world known as New London, doing two jobs: the one she was supposed to look like she was doing, and the one she was actually doing.

The one she was supposed to look like she was doing involved collating economic analyses of the latest major transactions of exo-confederate corporate states, Bettelhine and

Dejahcorp and Trawleny and the like. They were rival powers, not-quite-enemies of the Hom. Sap Confederacy, with the potential to become enemies whenever the winds of fortune dictated. Even working a 5-D model with the latest known transactions of all principals, the job was intensely dull and, of course, not the job that she really cared about.

Late that afternoon, her superior Veronica Cheung came over and watched her work for a while, looming in the way that she did, tsk-ing after several long minutes of examination. "That can't be right."

Tasha thought she saw what Cheung did but feigned ignorance. "What?"

"You have some color overlap between the Bettelhine cloud and the Dejahcorp cloud. That's unlikely in the extreme. The two corporations are not just rivals but bitter enemies; they've had what amounts to a shooting war for years."

"And they'd never engage in open trade," Tasha agreed.

Her fingers flitted over the projection, magnifying the area under dispute.

"But they each have resources the other needs, and it's never been unknown for lesser administrators far from the central power structure to engage in barter of one kind of another as long as they can keep the bosses out of the loop."

She enlarged the area of greatest overlap. "This represents a flurry of back-and-forth over in the Leshothic Cluster; one of the administrators of Dejahcorp's wheelworlds there has been exchanging a little more than 10 percent of his annual production to subsidiary powers doing direct business with Bettelhine. It's wild-ly against the policies of both corporations, but I don't think he's letting his bosses know."

Cheung seemed to admire that. "Cheeky bastard."

"Not quite. His attempts to cover himself have been clumsy in the extreme, and he's been operating at such a loss because of it that he's going to have to either turn himself in to the law or defect to Bettelhine in order to avoid imprisonment."

"Can we make him an asset?"

"It would mean getting the corps to cover his losses."

Cheung didn't smile; it just wasn't in her to flash teeth, ever. But she had to appreciate the

opportunity to establish that rarest of all birds, a triple agent. "I like the way you think, Tash. You should get me a report on that by the end of the workday tomorrow. But as for now, you look like you're about to fall asleep standing up. How long has it been since you closed your eyes?"

Tasha had feigned a lot of things since joining the task force, but her answering yawn was not one of them.

"I thought so. You stay much longer, you're going to start making mistakes. Get yourself some rest and return when you can hold your head up."

"One more hour," said Tasha. "I have to wrap up."

"Ten more minutes," said Cheung. "Then save your work, and get yourself a goddamned drink or something." She pivoted on her heels and strode away, her spikes making clack-clack noises on the office's alloy floor.

Tasha had no intention of listening to this advice.

She gave her current task a full hour, moving data about, not uncovering a potential Dejahcorp traitor, but instead creating one, as the cheating bureaucrat she'd just described was wholly fictional. By the time she was done, the numbers painted a portrait of the wholly imaginary personality as detailed as any oil painting. Tasha could almost smell the man's fear-sweat when he tallied up his figures every day, his forlorn hesitation whenever he passed high places and contemplated ending himself before his perfidy could be discovered. Her personal image of him was that of a round-faced, jowly man with a bad comb-over and a permanent sheen of sweat, returning home to a wife who had barely two words to say to him and a son who had only half as much to say as the wife. She sprinkled in a few personal transactions to indicate that the poor guy lived beyond his means, in order to support a double-life, and stopped only when she realized that her numbers were in danger of transforming into a soap opera.

So she deleted the digital scaffolding that identified her fiction as a work in progress, backed up her work, and stopped off at the office where her other target, one Beau D'Eauffier, was taking a break himself. He had draped his oversized bulk over the lounge and seemed to be dreaming, eyes hidden under a hairy

forearm, when she poked her head into his office, but just before she left him alone, he murmured: "You're going to die, Coombs."

She laughed. "That's what Cheung said."

"You should listen to her. Nobody ever saved the kingdom by making themselves a shell. You're going to drain off what life force you have just trying to impress everybody."

She shrugged. "What do you want, I'm compulsive."

"Cheung's compulsive. I'm compulsive. We all have to be compulsive to do this work. But if you're like this when there isn't even a diplomatic crisis sending us to the bunkers, I hate to see what you're like when everybody's called in for a clock-burner. Have you even eaten today?"

Tasha was uncomfortably aware that this was the second time somebody had expressed concerns for her health. "This morning. I think."

"The day will come," he intoned, "when you realize you've missed the best parts of life. Come on. You only see this old carcass still hanging around because I need a nap just to gather up enough energy to go home and sleep properly."

She smiled. "I just have a few things to wrap up."

"For Jue's sake wrap them up then. This is not a conversation I want to have with you again tonight."

"Not much longer," she promised.

She left the division, did a speed-walk to the other side of the Dip Corps complex, spent a little time sipping coffee in a breakroom where nobody knew her, took her time in the restroom sending a coded update to her handlers, then returned to the division prepared to tell her superiors that she'd almost made it home before having to return to the office for something she'd forgotten. By then D'Eauffier was also long gone. The sound of her footsteps echoed wherever she went. She consulted the building's security records to confirm that this entire wing of the building had been as good as abandoned for more than an hour, spent about ten minutes debating her options, and then made what probably qualified as the most careless professional decision of her life.

She decided that going home would not be a problem.

* * *

The commute:

Tasha signed out and left the antiseptic halls of the intelligence division for the somewhat more antiseptic environment of the surrounding Dip Corps campus, well-manicured and lovingly landscaped, but always in her mind, impossible to see as anything but a tableau built on deceit and lies.

The Dip Corps was the face the Hom. Sap Confederacy showed to the other great powers of known space, but it was a rickety construct, based less on preserving the peace than in preserving the illusion that humanity's dominant power spoke with one voice. Some of what was entailed in making the illusion work involved the dirtiest of all possible tactics, and Tasha had seen enough of it to be cured of any fantasies she might have had about the confederacy's claims of being the shining light for humanity's future. It was, as far as she was concerned, just the best of a very bad lot. Somebody she didn't like very much had told her once that when she started thinking that way, it would be time to start working off what remained of her Dip Corps contract at some less psychically damaging assignment, like embassy work. And she'd been thinking that way for a long time.

From the quad she moved on to the slide-walk and from there to an express tube that should have delivered her to a bed and to a simulated lover who, because he made no demands on her limited time, was right now a fine substitute for the real thing. She didn't even want sex from the damn thing tonight; never mind that it had been longer than she wanted to think about since she'd been able to fit such an extravagance into her schedule. But the warmth of another body, however false; the soft reassurance of a loved one's breath against her back, however artificial; there came a point when that was necessary just to maintain sanity.

When this business is done, she told herself; when I nail the piece of shit to the wall—then I'm going to step back, get a transfer to something less time-consuming, and have a life for myself.

The habitat engineers had decided that it would be a warm night with a starry sky, and so Tasha took her time during the two extended periods when she was on foot, stopping at one point for a meal of protein buzz and

slowing down to slurp it through a straw as she gazed up at the false starscapes shifting and dancing across the surface of New London's central hub: not quite the sky of the rural world where she'd been raised, nor a persuasive illusion, but better than the sense she always got of a great metal club, poised to smash the jumped-up country girl flat.

She was almost wistful when she turned the corner of the corridor that accessed the neighborhood containing the cubicle complex she called home; thinking of anything but the tactical dangers of her surroundings.

Her attacker jumped her then.

Tasha's first impression, even as the blade sliced through her suit and drew a line across her ribs, was that this was just street crime.

Muggings as such largely didn't happen on New London. Currency was not totally unheard of in the confederacy, because member worlds encompassed such a wide spread of human civilizations, but here all commerce was direct transfer from one account to another. There was no particular need for anybody to carry valuables. But random assaults, rapes, crimes of passion: these happened, because people were people. When the burning pain hit her side Tasha even had enough time to feel the irony of possibly falling to a mundane threat so close to home, after surviving far greater dangers on assignment to distant worlds.

She reached for her sidearm. Her attacker seized her by the wrist before she could clear it and tossed it aside, before ramming her against the wall a second time.

Tasha thought *to hell with this* and got serious.

Getting serious would have normally meant the death of any amateur who took her on in close quarters.

But her attacker blocked what would have been a deadly counterblow had it been wielded against any moronic street thug.

She was treated to her first close-up look at the angry but fear-driven face behind the knife.

She recognized her enemy, and along with the rush of surprise—because she'd been leaning toward the belief that the attack would come from the other one—came the awareness that this had been the worst possible night to succumb to a craving for the pleasures of home.

The words shouted in her face were hoarse, driven, tremulous: the tones that can enter even the most civilized human being's voice when the veneer of the civilized is ripped away by the prerogatives of self-preservation. "WHAT DO THEY KNOW?"

The average person wounded as badly as Tasha was would have succumbed to the deadly illusion that providing answers offered a possible path to survival.

Tasha knew better. This little act of desperation had just incriminated her attacker in far more than a simple assault. There was no chance of this encounter ending with Tasha being allowed to live; compliance was, like surrender, a direct path to extinction.

She screamed, leveraged the piece of shit to the ground, enforced her opinion with a savage kick to the belly, only barely evaded an attempt to grab her ankle, discerned that none of this had put her enemy down for good, looked for her sidearm, saw that it had slid somewhere out of sight, and judged that any attempt to retrieve it now would only succeed in keeping her within the killer's reach.

She fled.

Her side bled, and running made it bleed more, but it was a shallow wound; not the great big gaping gash of the sort that spills organs or fluids in quantities that leave a corpse after a few agonized steps, but a shallow cut meant to terrorize that could only kill her if she let the pain stop her from attempting escape.

She had a chance: if not to outrun her assailant or put a door between them, then at least enough to get into position for a counter-attack, or to make it to a place where other human beings could be found.

She hated that the sounds coming out of her mouth were those of a panicking helpless girl. But she didn't try to stop them or the tears that had sprung, unbidden, to her eyes. Those, she knew, were involuntary physical responses. Fighting them took more energy than it was worth.

Behind her, in hot pursuit: "Don't be stupid!"

She turned another corner at random and saw right away that this was the wrong decision. This corridor, a route she had never traveled, stretched so far away, into the unreachable distance, that the floor and walls

and ceiling converged into a point that seemed slightly above center in what may have been a manifestation of New London's curvature. There was no place to go but straight ahead, no side passages in which she might find shelter. The pain in her side was eloquent testimony that if she rested all her hopes for survival on just outrunning the death coming for her, she would be no better off than she would be simply stopping to embrace it with welcoming arms.

But she was in luck. She spotted a small mechanism gliding across the floor about a hundred yards ahead, and recognized it: a cleaning drone, making its nightly rounds as it swept its environment clean of dust. That gave her something else to look for, and she found it, midway between that squat shape and her own position: the distinctive opening known as a "mouse hole" that had never been home to any mice but which was instead the recess where cleaning mechs stored themselves when not in use.

If she was lucky it might be deep enough to shelter her during her last stand.

It was close, very close; the sound of running feet, behind her, had grown so loud that she expected the next slash of the knife at any second. But she had time to sidestep, fake a dodge to the left, then go left anyway and dive into the tunnel just large enough for her to speed-crawl in, on her hands and knees. Hands grabbed for her, and she kicked them away, unfortunately not landing an impact hard enough to bruise; she pulled herself forward, aware that any second now she would reach a dead end and find herself trapped with nowhere to go but back into the corridor where her would-be murderer awaited.

She was lucky, though. There were no other drones in residence. The tunnel ended in a shadowy cul-de-sac spacious enough to permit turning and she drew herself up, with her back against the wall, glaring back at the tunnel she'd just traversed.

She saw that she'd just left a moist trail.

Her exertions had opened her wound, causing more pain, and unfortunately causing more weakness. Dizziness assaulted her. She took four deep breaths and shook her head, forcing alertness back into her brain as she steeled herself for whatever came next.

The light in the tunnel flickered.

A now-hated voice called out to her. "Tasha? I can hear you gasping."

"I can hold out until help comes."

"I don't believe you can. And even if you shut yourself down, I can boot you back up. I can bring you to people who can take their time getting what I need from you."

"Bullshit."

But the chuckle came rolling down the tunnel anyway. "Did you honestly believe that I would move after you, even in desperation, if I hadn't researched exactly how to get what I want from you?"

The light in the tunnel flickered again, becoming just the few narrow strips of white left unclipped when the rest of the space was taken up by an advancing form.

Tasha shifted and felt the pain flare in her side.

She knew she was about to be taken.

Andrea Cort:

They didn't give me any choice about coming with them. They didn't even tell me why I'd been summoned out of a sound if drugged sleep, in the middle of this, the third month of my house arrest on New London.

They just insisted. Insisted hard. In the manner of men who made it clear that if I would not walk I would be carried or dragged.

I refrained from asking questions because that's something I do only when further information can alter an outcome, and thirty sections of sleepy *you're-kidding-me* directed at the two scowling presences at the foot of my bed didn't win me anything other than five seconds of *no-we're-not*.

I did refrain from killing them with any of the weapons I'd begun secreting on my person even in sleep, because I was already in trouble for killing a man, and adding these two behemoths to the list would have still left me with the problem of somehow getting off New London and out of Confederate Space. I still gave fifty-fifty odds of the corps choosing to incarcerate or disappear me by the end of the day but going peacefully kept my options open.

I was lucky enough that they agreed to withdraw from my quarters to let me get dressed for work in private, a kindness that permitted me to transfer my weapons from my sleep clothes to the severe black suit I use as both uniform and armor. This made me feel a lot

better about my preparedness when it turned out my escorts had no intention of taking me through any corridor or public place where I might be seen in their company; instead, they were determined to take me out unseen, through utility corridors and fast-transit tubes used only by security personnel. I upgraded my estimated odds of soon having to fight for my freedom to seventy-thirty.

One long uncomfortable commute later, they brought me to a suite of offices I didn't know, and to a featureless little room where I was locked in, to await my fate. Not one single word of explanation had been asked for, or offered. The odds now seemed ninety-ten. I sat in one of the two chairs facing each other across a table and waited with clasped hands, determined to wait out any hidden observers who might be analyzing my every gesture for tips on breaking me.

I expected to wait hours.

But less than a minute after I took my position, the door slid open, admitting a man I loathed beyond measure.

I said, "You bastard."

Artis Bringen was a wispy-thin, smooth-cheeked functionary who, for reasons of his own, had had himself auto engineered to look like a boy of no more than fifteen years. The concessions to his actual age were a hairline trimmed back to accentuate his glacial wasteland of a forehead and a pair of world-weary eyes that his obsessive overuse of rejuvenation treatments had not been able to lend the same apparent youthfulness as his face and body.

He was my boss, which—thanks to my shaky legal status as childhood war criminal, even before this latest trespass—also made him my keeper.

He sighed. "Someday, Andrea, I'll walk into the room and you'll say hello. Or good morning. Or even how are you. Something other than another redundant reminder that you hate my guts."

I said, "You shouldn't hold your breath. What kind of trouble am I in?"

"You're not in any trouble."

The knot of tension in my belly dissipated a little, at the offhand implication that I might be able to look forward to days other than today. "What about the Zinn?"

My recent turbulent mission to the homeland of the Zinn was the reason I'd been

under house arrest these few past months. Routine busywork that should have involved nothing more complicated than my signature to a chain-of-custody agreement negotiated by parties well above my pay grade, it had instead ended with me nullifying the agreement, murdering a man, and advocating a permanent military blockade of the planet.

Granted, I'd had the best possible reasons.

But these were not the kind of decisions any low-ranking, freshly minted Dip Corps counselor can be expected to get away with. I'd spent the last few months waiting for the hammer to fall and expecting Bringen to be the one to drop it.

He surprised me by shaking his head. "You were the subject of discussion for a while, and I'm afraid the killing is always going to be a black mark on your record, but nobody in the investigation can deny that you stopped us from making a terrible tactical mistake. Unofficially, we're even grateful."

"The Bocaians, then?"

"That guess doesn't even make sense. Please. Use that logic you're getting so famous for. Why would we go to such lengths to protect you from the fallout of your actions among a people as powerful as the Zinn, if we were then only going to surrender you to a provincial backwater like Bocai?"

I held on to my hard-earned paranoia a little bit longer. "Perversity?"

Only a dedicated enemy would have joined the charge against me as many times as Bringen had, but he had one particular bad habit that made hating him more nettlesome than hating most people: the hurt look he flashed whenever I failed to give him the credit he thought he was due. "Come on, Andrea."

I've become an expert in the various classifications of enemy, over the years. The worst are those who think they are on friendly terms between assaults; those who think that what they take from you, they take for your own good. Bringen was so clearly in that camp that he sometimes exuded frustration at my disinclination to accept his claims of friendship.

I gave him no further room to protest. "So what do you want?"

"We have a problem for you."

I shrugged. "I'm under suspension."

"You've been specifically requested."

"I'm still under suspension."

"It might save the life of somebody you care about."

"I can't think of a single person who fits that description."

"It's Tasha Coombs."

Tasha was one of my fellow counselors; we'd gotten our degrees at about the same time and, as one of our first projects, spent a year in close quarters working on a joint project of sublime dullness.

We were two strong alpha personalities, of unfortunately incompatible types. She had more social skills than I did, or likely ever would, but was also a child of privilege used to having her own way in any dispute; I was the ball of anger I am, intent on taking charge out of sheer insistence on my own infallibility. Past a few days at the beginning, when between my reserve and her surface pleasantries we'd both made a well-intentioned effort to get along, the atmosphere between us had quickly devolved to open hostility. For a while, until we decided to be coldly robotic in each other's presence, speaking only to exchange work-related information, we'd gotten along about as well as two rabid animals in a canvas sack.

Since then I'd joined the Judge Advocate's office, and she'd entered the more shadowy world of Dip Corps internal security and we'd not suffered any further contact.

Any implication that I might have anything to do with some predicament she'd gotten herself into now was ludicrous; also an anomaly of the sort I could not permit to stand.

"Show me."

Twenty minutes later:

Tasha didn't know where she was or who she was. She was a closed system, trapped in a moment of her own creation, a moment that offered no means of escape. As a noted wit had once said of a home world city known for its dullness, there was no "there" there.

When I'd known Tasha she'd had light mocha skin, shoulder-length brown ringlets and brown eyes that had once been penetrating but now utterly failed to generate any of their own natural heat. Some of that had changed for reasons either professional or cosmetic. She'd darkened the skin three or four shades, cut her hair to a gray buzz, and created a designer eye color closer to orange than anything you would normally find on an

unenanced human being. I couldn't tell if her physique had changed as well, for better or ill, because she was imprisoned by life support that enclosed her up to the neck, keeping her fed and exercised and clean, but never reaching the void behind her eyes. Her face bore no sign of the intelligent, involved, pain-in-the-ass woman I'd known; instead, her mouth and her eyes hung slack, unsupported by any conscious effort by the soul trapped deep inside her. It was tempting to think of some part of her screaming in there, but I'd been in the same condition myself a couple of times over the years, and I knew that she was unaware of the passage of time, of her current sorry state, or of her own utter inability to think or act.

"Teemed," I said.

"Teemed," Bringen confirmed. "She also had some other wounds, and the blood trail from the alcove where she was found indicates a fairly protracted flight from an assailant bearing an edged weapon. But those we were able to heal in short order."

"How long has she been unresponsive?"

"Fourteen days, give or take."

I frowned. "She should have recovered her mind by now."

"This is a special case."

The weapon that had reduced Tasha to this had a formal name of little evident poetry but was popularly known as a "teemer," a neologism coined by one of the bastards who invented it out of T and M, two consonants from a now dead language that had once been the abbreviation for the legal term, "trademark." The significance of that required underlining, and the research I'd done after the one and only time it happened to me had not been especially illuminating. It seemed that there'd once been an insanely popular beverage known as pedsis, or something like that, whose sellers concocted advertising jingles that, once heard by the consumer, were fiendishly difficult to dislodge from conscious thought. People hummed them, sang them, listened to hours of more enjoyable music to wipe the ditty from their meatware. Then they inevitably ran into the advertising again and were reinfected.

Teemers operated on a jacked-up variation on the same principle. Operating via eye contact with their victims, they strobed a high-intensity viral image that so completely

imprinted the target's mind that conscious thought and personal volition became impossible. For up to a week, until the effect faded, the victim was too focused on the image to be able to see, hear, feel, or act.

Teemers were riot gear, the most humane weapons to use against an unruly mob, but I got hit once when trapped in the middle of a New London street riot, and I've got to tell you, they're a definition of humane I can't even begin to credit. Not only is the sense of helplessness retroactively terrifying, but recovery from the effects isn't always as fast or as easy as the technology's defenders claim. Some teemer victims suffer flashbacks, leading to further spells of incapacitation, at odd moments for years afterward . . . and since the wielders can program any image at will, there's a despicable tendency among some of the nastier people wielding authority to program in images disgusting and/or pornographic. There are even reports of some governments teeming their political prisoners over and over again, allowing them only moments of self-awareness before putting them back into the limbo of their own skulls, a process that, over time, permanently damages the brain's ability to recover from the treatment.

Teeming's terrible. People have been ruined by it.

But most teemers wore off after less than a week.

Bringen said, "The device used on her . . . it was, well, a highly classified and somewhat more advanced version of the weapon you know. The image it imparts is self-repairing, designed to reset to the original whenever the brain starts to react to outside stimuli. Unless we do something, she'll be like this for the rest of her life."

I pulled the thumbnail out from between my incisors and shot Bringen a revolted look I might have reserved for mass murderers and rapists. "And just who brought that obscenity into the world?"

He pinked. "We did."

"Well, this has got to be a slimy justification worth hearing."

We weren't in an ordinary hospital room but in an illicit clinic the corps maintained on-site for its more embarrassing problems, a subsection of humanity that had for some time included me. But the amenities included

reasonable attention to the needs of authorized visitors, and one of those was the soft chair that Bringen sank into now, looking as defeated and as shamed as I'd ever seen him. He covered his head with his hands and said, "Don't put this on me, Andrea. I never approved of the damn thing. I just work for the people who did, the same way you do."

"I'm still listening."

He rubbed his eyes. "You know how, once upon a time, spies used to carry poison pills, so they could commit suicide if they were ever in danger of being captured and forced to spill what they knew?"

I'd seen that referred to in some of the sillier fiction I've seen. "Go on."

"This is considered an improvement on that. The way it works, the agent gets implants on her optic nerves. If she ever finds herself in imminent danger of compromise, she can teem herself with the right mental signal and put everything she knows beyond the reach of an enemy. It makes her useless as a prisoner, because she's impervious to torture or intimidation, and therefore impossible to question."

"It's also a virtual guarantee that any enemy who knows about it won't even bother to try to take her alive."

"True. It's more compatible with long-term survival in those cases where the operative's working on soil we control and can be retrieved by authorities capable of restoring her cognitive functions."

I glanced at Tasha. Her mouth had fallen a little bit open and was loosing drool. It was tempting to think this qualified her as an idiot, and I'd be lying if I said that the part of me that remembered our many fights wasn't tempted to take a little savage pleasure in that. But I had a problem unconnected to any pretense of a working conscience: my respect for intelligence. As far as I was concerned, the destruction of any working intelligence was an obscenity. I said, "So you're saying that there's supposed to be a release, a fail-safe of some kind."

"Of course there is."

"But you haven't used it."

"We don't have it."

"Aren't you supposed to have it?"

"Now you're beginning to see our problem."

My head began to hurt. I paced from one wall to the other, cogitating, then closed my

eyes. "Get me the hell out of here. I need some fresh air and can't think with her in the room."

Five Minutes After That:

He took me outside, or as close to outside as it's possible to get in a cylinder world like New London. It was a spacious balcony thirty stories above the Dip Corps's campus grounds, overlooking a green field and a pond where water jets sent silver sprays aloft in one of those eternal liquid ballets whose appeal I have never personally understood. It was early morning local time, and the solar lamps in New London's central hub had just begun to flare to the brilliance they affected during the day; the air circulators had manufactured a controlled breeze, and the curving horizon revealed the first signs of activity in the town's residential and commercial sectors. I didn't like heights, and therefore I didn't like balconies, and therefore I was on edge; a feeling I embraced because it was an edge I needed.

Bringen took me to a table in the artificial sun and placed a small, oblong device between us. It was a hiss-screen, ensuring that anybody trying to eavesdrop on us from a distance—unlikely, as that kind of thing takes advance planning—would hear nothing but a wall of white noise.

He sat. I didn't.

He said, "The two of you were not friends."

"No. We weren't. She hated me. I hated her."

"Hate's a strong word."

I flashed annoyance. "If you want me to say that I didn't lie awake at night thinking of ways to kill her, no, I didn't hate her by that precise definition. But I was still relieved that she was out of my life and that I was out of hers."

"You would like a lot of people out of your life, wouldn't you, Andrea?"

There was that look of hurt again, possibly pretense and possibly self-delusion; the attitude of a man who believed that his offenses added up to nothing, and that the resentment of those he had hurt added up to salvageable misunderstanding.

I said, "If you have a point, please make it."

"You should know this. One of Tasha's earliest internal security assignments, an elementary test of her perceptive abilities only tangentially related to this current problem,

was writing up her personal character assessments of various Dip Corps personnel who have fallen under one cloud or another. This is one of the closing paragraphs from a two-hundred page report she wrote about you."

He tapped the htex port at his collarline, and Tasha's cool, mellifluous voice filled the air between us.

Tasha said, "Andrea Cort's detractors have called her unstable, antisocial, self-hating, angry, and paranoid. These are all undeniable elements of her emotional mix, fostered in her by the life she has led, and are so prominent that they discourage others from seeing anything else: among them her incisive intelligence and a sense of personal integrity as absolute as any this observer has ever seen. Despite worries that her profile marks her as prime recruitment material for an enemy power, it remains my personal assessment that the chances of this ever occurring are remote in the extreme. She may never be someone to like. But she will be someone to trust. I would put my life in her hands in a heartbeat."

He clicked the report off.

Tasha's voice had only warmed the growing knot of tension in my belly, and her opening words had heated it to a slow boil. Her conclusion hadn't mollified any of that, but had instead robbed me of any place to put it.

"Damn you," I said conversationally.

"In case you're wondering, my own professional assessment on file has always said the same thing."

I repeated, "Damn you."

He sighed the sigh of the long-persecuted and looked away, regarding the distant, curved fields of New London's farmland with the eyes of one hoping they possessed some landmark he could use to guide him past this dangerous territory.

After a moment, not facing me, he said, "When she was in the worst trouble of her life, with nobody around to help her, she put everything she had on your shoulders. You want to call that hate, feel free. You want to maybe rethink your premises after you've done this, feel free to do that, too. You'll do what you want in any event."

"You didn't wake me up out of a sound sleep just for the sheer joy of lecturing me. Tell me what you can, starting from the beginning, and I'll see what I can do."

He hesitated, but I could tell it had less to do with reluctance to share sensitive material than the habits of a man accustomed to secrets who needed to consider those he chose to share.

After a moment, he said, "All right.

"About two years ago, classified information belonging to the Dip Corps was found on an off-site database belonging to an unaffiliated human entity outside the confederacy."

The various worlds that make up the confederacy account for some 81 percent of humanity's trillions, but there are some remaining players, corporate and governmental, that never joined, and some of them were serious troublemakers.

I said, "Of course, you never would have known this if you didn't have spies in their camp as well."

He spread his hands. "That *is* the way it works."

"What was the information?"

"To fully brief you on that, I'd need days. Suffice it to say that seven operatives working under highly difficult conditions in locations far from home were compromised; two of those never made it back. There was no way of knowing how many others have been endangered, but the potential remaining loss of life and the blow to our interests cannot possibly be overstated.

"We naturally wasted no time tracking down the leak. From various internal indicators I also don't need to go into, we knew that the source of the transmitted information came from someplace here on New London, so we sent each of our on-site divisions a test file designed to look important, and tracked exactly how long it took the same information to show up, verbatim, in the data of the government we believed responsible.

"Of course, we also made sure that each version of the file contained a few unique elements, involving no more than a couple of decimal points in certain vital statistics. In this way, when those elements showed up at the enemy's location, we knew exactly what office was involved."

I nodded. "A little like filling a boat with water to determine the places where the hull leaks."

"Right," said Bringen. He went on:

"Identifying the specific office narrowed our problem down to one pod of trusted intelligence analysts: three men, two women, one

neuter, working in close proximity. Various other factors you don't need to know about cleared the neuter, one of the men, and one of the women. But isolating the actual culprit out of the two who remained was more difficult, as any open questioning would have simply alerted that party to shut down all of his, or her, illicit activities.

"That wouldn't solve the problem. The division would still need to be shut down because of the breach. A number of important operations would have to be curtailed. Both the guilty party and the innocent one would always remain under suspicion, which would mean two important assets lost when we only needed to eliminate one."

"And also," I said, dripping acid contempt, "one actual innocent life ruined, which I'm certain remained key among the considerations you wished to avoid."

He flashed that hurt look again. "That should go without saying, Andrea."

I sniffed to indicate that I didn't believe it at all. "Go on."

"As it happened, Tasha was rated for the kind of work these people were doing. We transferred her into their office and had her watch both to determine which one was our traitor. It was sedentary office work, here at home, but it was still considered a risky assignment, as both of our suspects had also worked in the field under dangerous conditions and could be expected to defend themselves with deadly force if necessary. If Tasha ever tipped her hand, it would be well within character for the guilty one to lash out. She could be killed. Worse, on a strategic level, she could be captured and tortured for information on what we already knew, let alone on just what compromised intelligence was false. She was provided the teemer implant to limit our losses in case our culprit ever got close to what she carried in her head."

"And I gather that happened."

"Clearly. She went off-line and was discovered in a niche for maintenance drones in a corridor about five minutes from her home. As near as we could figure it the drones started returning to the alcove before her assailant could get to her: that bitch or bastard was forced to flee, and the drones saved Tasha's life by reporting the discovery of what they assumed to be a critically injured rape victim. Whoever

confronted her appears to have been scared off before doing her any permanent damage. But she remains nonresponsive ever since.”

I sighed, strode away from him, thought furiously for several seconds, then returned and said, “So let me see if I can use her current condition to extrapolate what happened. Tasha found the identity of the guilty party elusive. She laid a trap of some kind, giving him a chance to self-incriminate. Whatever measures she took to protect herself failed; the culprit caught up with her on the street and in some way, likely superior weaponry, possibly just by drawing blood first, demonstrated a tactical advantage Tasha knew she could not beat. Tasha took herself off the board, the guilty party got away undetected, and you found yourself with the same problem you had before, except with your traitor now aware that you’re on the case, and Tasha no longer useful to you.”

“You’ve got it.”

“I suppose there’s no forensic evidence, security footage, or ancillary evidence that points to either of your two suspects over the other.”

“There’s plenty of evidence, Andrea. But it points in both directions. It’s all ambiguous, right up to the moment where Tasha teemed herself: for both suspects, just as much supporting their respective innocence as their respective guilt. There isn’t enough of it, on either side, to be definitive. There are indications that some of what we have might be faked. But so far we haven’t been able to tell which way the disinformation is targeted.”

I cupped my right elbow in my left hand, and paced, nibbling on my thumbnail again. “It’s an interesting problem,” I admitted. “Even if you could determine which evidence was faked, there’s no guarantee that your traitor didn’t self-incriminate, hoping that you’d see through the provided evidence and find reason to suspect the other.”

“We have volumes of the stuff,” Bringen said. “And it’s all useless, for that reason. You can look at it if you have to. But that’s exactly where everybody else before you has gotten lost.”

I didn’t regard that prospect with anything but dread. The dossier would be exhaustive, and it would be meticulous, and because my security clearance wasn’t nearly as high as Tasha’s, it would also be heavily redacted, containing more gaps than hard islands of pure

data: all enough to stymie the most anal in what had to be a small army of analysts. Bringen wasn’t a remarkable mind, by my estimation, but he wasn’t an idiot either. If he said the answer was drowning in too much data, I believed him.

If I was the key to this problem, I was the only key.

I said, “Two last issues. What’s the fail-safe and why don’t you have it?”

“It’s supposed to be a specific code word that can be uploaded in a later image, that overrides the first image’s ability to repair itself, and jump-starts the individual’s thinking capacity with direct neural stimulation. If we had that word, we could bring her back up to speed in a matter of minutes.”

“That would make sense. But you said you don’t have it.”

“She must have changed it after the last time she checked in.”

“Why would she do something that stupid?”

He rubbed his eyes, for what I perceived must have been the hundredth time in the last few days; they were red and worn, glassy with a frustration that I could almost taste. “It’s something she would do only if she had reason to believe her fail-safe was itself compromised. After all, there’s absolutely no advantage in shutting yourself down, if your enemy has the means to just start you back up again. So our people always have the capacity of changing the code, and the image the flash imprints on the mind, to substitutes of their own choosing. It must have been at the very last minute; she’d last checked in with us a couple of hours earlier, and at that point didn’t have any new information to impart . . . but sometime after that she must have found herself trapped and in trouble and unable to contact us.”

“The teemer itself doesn’t keep a record of the code?”

“If it stored the code in any form that could be read, the enemy could obtain that by removing and examining the device. No. The code’s in her head, an inherent weakness in the image that’s overwhelming her.”

“And I gather you can’t just start sending random words until you pick the right one.”

“Because that could take hundreds or thousands of tries. The human brain was never built to be teemed at all, let alone that many times. It would inflict permanent psychosis.”

Curious, I said, "How many could you get away with?"

"Considering how often her current teem image must have been refreshed, by now . . . two. Three. With her prospects of regaining sanity even with the right word growing more remote, all the time."

My relentless nibbling at my thumb had drawn blood. I examined the wound, thinking of how often the terrible habit had caused wounds just like it, and wondering how many other less obvious wounds I dealt myself on a daily basis. After a moment I said, "Final issue. You said she requested me."

"Yes."

"You can't just be referring to that analysis you excerpted."

He tapped his hyltex link again. A holo appeared in the space between us, and I was sorry to say that I knew the image very well. It was the official 360 degree head-shot of me that once appeared in the Dip Corps database, an image that in its intense demeanor and in its clear resentment of the portrait-taking process communicated everything most people find objectionable about my personality. My lips were curled in an attempt to smile that looked more like a grimace, and my eyebrows were knit in what I'd once intended to look like a penetrating look but was instead the most anti-social scowl imaginable.

Out of rare concern for the impression I made on others, I'd appealed to the people who maintained the database and gotten that portrait changed to something no more charming but several shades less psychotic. But the damage was done. Among my enemies, the image is a prized if rather petty weapon, excavated to be attached to any report that might reference me. It had certainly enjoyed a great resurgence over the past few months since the business with the Zinn: the perfect visual to go along with any argument that I'm too unstable to ever be allowed any more responsibility, ever again.

My current expression must have been something very close to it. "And this?"

"We may not be able to get the correct fail-safe from the device, but it was designed to retain the image it imprinted on its target, in case that ever contained important information. This . . . is the image that's been crowding out the rest of Tasha's cognition, the last two

weeks. We know it was the last thing she unloaded, before shutting herself down; the one thing she risked having stuck in her head for the rest of her life. This. We took it as her letting us know that we should go to you. But what you know, is something none of us can guess."

I thought about it. Then thought about it some more.

Bringen said, "You're smiling."

So I was. I was sure that it wasn't a nice smile, either; it would have been half-bitter and half-knowing, all victorious, not at all warm. "There's something we can try."

Sometime later:

There's a rule of thumb, among those who hunt and prosecute criminals, that you can pretty much tell whether suspects are innocent or guilty by leaving the accused alone in a room and observing their behavior.

It doesn't work the way intuition would suggest.

Innocents have done the right things, obeyed the proper rules, and not trespassed in the manner they have been arrested for; they are therefore victims of caprice, and they tend to react with escalating apprehension, nervousness, and fear, as they wrack their brains for some means of bringing the universe back in line with their logical understanding of actions and consequences. The guilty are nervous, too, but they've already been living with the knowledge of their actions and have been, on some level, emotionally preparing themselves for their current predicament. Finding themselves in the place where their actions sent them is more of a confirmation that the world around them does, in fact, work exactly in the manner it was always advertised to function. They react with resignation, boredom, and impatience over just how long it was going to take to get past the current bit so they can move on to the next part. The theory goes, an innocent person left in a room starts climbing the walls. A guilty one goes to sleep.

It would be nice if the rule of thumb were reliable enough to be used as a tool in convictions. Alas, human variation plays its part. Some, guilty or innocent, just refuse to believe that the universe will ever permit anything bad to ever happen to them. Some have anxiety triggers that can induce near panic even if the

only penalty at risk is a nominal fine. And others are sociopaths for whom the normal variables of good and evil are just plain irrelevant; the way their minds process such questions, anything they've done is so perfectly justified by need that it's just plain not worth worrying about.

And then there are the professionals, like the two before me: the ones who had been trained in exactly what the signifiers were, and who had been subjected to background checks and security screenings so frequently that this was a test no more formidable than those they'd taken a thousand times before. I saw no nervousness, no paranoia, no damning absence of tension: just a cold angry determination to get on with it.

They were in the same room, at adjacent tables separated by a narrow gutter; both knew what this was about, both were deadly, and both had been given the same neural block to render them temporary paraplegics for safety during the interrogation. They had shared the room for two hours and had suffered in silence, waiting for my entrance. They hadn't even looked at one another, not for a moment.

The woman was Veronica Cheung; tall, slim, athletic, with a high forehead, and hair that was, like mine, cut helmet-length. The man was Beau D'Offier: thick-jawed and balding, with a gym physique that had started to go soft at the edges. He looked ten years older than Cheung but was, from the file, five years younger: a conscious decision to accentuate his apparent age in a bid at enhancing the authority he had over his division.

I disengaged the lock on the door and entered carrying a cup of coffee, not looking at either one of them at all until I had taken my position at the blank wall they'd both been forced to stare at for two hours. This was standard prosecutorial technique, further breaking down the resistance of the suspects by taking my own sweet time to acknowledge them, but though it had worked for me on the small handful of interrogations I'd been able to have a part in so far in a career that was not yet stellar, I found that when I faced them they were both unimpressed and facing me with a remarkable lack of intimidation.

I said, "Before we begin, I'd like to ask if there's anything I can get to make you more comfortable."

D'Offier snorted. "Give me a break, Counselor whoever-you-are. Just how green do you think we are?"

This was an invitation to either answer or to say that it was none of his business, either way acknowledging that I was younger and less experienced, and therefore, that all my textbook knowledge about psychological manipulation was irrelevant.

I smiled. "It's not an attempt at manipulation, I assure you. I know you're both too experienced to be taken in by such things. It's just me being hospitable."

D'Offier said, "It's you trying to position yourself as a figure to trust, and I've questioned enough criminals and terrorists to know better. But I'll take a cup of water, if you don't mind, just to get me through this."

I turned my attention to Cheung. "And you, ma'am?"

"I'll have a water, too. With the same understanding as my ex-colleague, the piece of crap traitor over here. It's not going to affect the power dynamic in this room, not in the slightest."

Whatever it said about me, I found myself feeling a kinship with these guarded and paranoid people. Maybe I'd taken the wrong career path.

"Very well," I said. "The people monitoring this conversation will make sure they bring enough for both of you. My name's Andrea Cort. Do you know who I am?"

"The name's familiar," D'Offier said. "I know it's come up in some file or another."

Cheung said, "I recognized you when you walked in. I also know that you've been in legal trouble again, and that you don't work for internal security."

I sipped my coffee. "Correct on both counts. As of this morning, and in recognition of the help I'm providing your division, I'm back working for the Judge Advocate's office. The session we're about to have will be brief, as my duties regarding this current situation are tangential."

"They would have to be," Cheung noted. "Last I checked, you don't have the clearance for any of the intelligence at stake. You don't even have the clearance to talk to us about it."

I emitted a soft, pitying chuckle.

"No. I don't. And if either one of you says anything that directly references the information in those files, or covers anything to do

with the spying investigation, the people monitoring this conversation will pull me out of here at once, before I hear enough to make me a security risk."

"A further security risk," said Cheung.

"That too," I agreed, with no special heat. "In fact, I want to make this perfectly clear. Except for that offer of refreshments, I honestly don't intend to ask either of you any questions at all."

The two wore the expressions of venomous snakes, secured just below their jaws. They knew I would not surrender all possible power in this negotiation. But they also knew that I had just ceded their key point of advantage: their ability to answer or stonewall my questions. And so they measured me, wondering how I intended to get the information anyway.

But I was telling the truth. My life was already paranoid enough. The last aggravation I needed was any connection to classified material capable of complicating my existence further.

I honestly didn't want to know.

D'Offier said, "Then what are you here for?"

"Well, I'm not here to fool you into self-incrimination, that's for sure."

I gulped the rest of my coffee, tossed it in the trash, and turned to D'Offier.

"You're right, sir. I'm young. I'm also controversial and, according to my superiors, seriously unstable. For those and other reasons I haven't risen in my own career as meteorically as my colleague Tasha Coombs did. I'm absolutely certain that I have not yet picked up the skills or the experience to outmaneuver people like the two of you, who have received so much training in the fine art of maintaining one's cover even when subjected to the most hostile interrogation.

"I can't manipulate you, either of you. If a few words from the likes of me were all it took, they wouldn't have had to send Tasha undercover in the first place. And since whichever one of you attacked her did see through her, any chance a relatively inexperienced non-spy like myself might have of being able to accomplish in minutes what she failed to do over months is minimal.

"Put the bullshit aside and accept as given the obvious truth that deception of any kind cannot possibly be the reason I was sent in

here to speak to you. No. I'm only here to present you with your options."

I watched them both, to see if I could derive any cues from which one nodded first—but though Cheung went first by about a second, this by itself was not significant. It only reflected current processing speed.

She flashed a crooked, appreciative smile. "This doesn't have anything to do with me, Counselor. But I'm listening."

D'Offier said, "She's the guilty one, not me. But I'm listening, too."

The door opened and one of the security personnel entered carrying two cups of water, placing one before each prisoner. Cheung and D'Offier each took sips, then put down their respective cups, waiting.

I began to pace. "All right. As I said, I know next to nothing about this side of the building. All the knowledge I have of the spy trade is theoretical.

"But common sense does tell me some things.

"As I understand it, the traditional problem with capturing and prosecuting a spy is that once any spy is no longer a source of information for the enemy, that enemy has immediate reason to try to put another in place. This can be a difficult proposition because the first leak has been patched and more stringent security procedures will certainly be put in place, but the fallibility of all organizations being what it is, another spy will get through; another leak will open up; more sensitive information will be passed.

"Except for the satisfaction we take in disgracing and ruining and possibly even executing a piece of crap who deserves that and more, there is no net gain.

"But if we can confront the same spy, ensure that he or she knows that continued freedom and privilege can be revoked at any time, we can continue to use the leak already established to transmit whatever false information we want transmitted. I'm correct on this, right?"

D'Offier said, "We don't need you to explain disinformation to us."

"No," I admitted, "you don't. I'm just being meticulous in my presentation. The curse of a too-orderly mind.

"Now I'll get to how our current predicament impacts the one we know to be guilty.

"You see, the corps can't prosecute the responsible party for spying, not without acknowledging that the spying took place.

"What it can do is prosecute the responsible party for the physical assault on Tasha Coombs.

"The Judge Advocate's office I serve can see to it that you are charged with all of the most serious versions of your charges, not just assault but also the related charge of attempted murder by depraved indifference, which you opened yourself up to by abandoning poor Tasha in that alcove after she entered her current incapacitated condition.

"Further, we can balloon the number of charges to as many as the letter of the law permits, and we can press any sentencing judge to make sure that your sentences are served consecutively.

"Only then will your sensitive government position be brought up, to justify your imprisonment in maximum-security isolation.

"You would, I fear, never be permitted to communicate with another human being again. I promise you, you would go insane in short order.

"We already have enough evidence to make sure that you're convicted. But it would be a long and arduous process, and you would be forever lost to us as an asset."

I let that hang in the air for a few seconds.

"Alternatively," I resumed, "you could confess to the assault and attempted murder, with the understanding that you will not be prosecuted and that it will only be used as a guarantee of your future cooperation. You will not be free in the usual sense of such things, as your every movement will be supervised from now on, but you will be able to keep your own home, continue to earn money, even have friends and family.

"All we'll expect of you is that you transmit any information we demand, whenever we demand it, for however long your method of transmission remains viable—with the understanding that if you ever betray us in any way, the charges against you can always be revived.

"That's the deal. Any questions?"

The two of them looked at one another, as if in consultation, before realizing that the proffered terms applied to only one.

Cheung said, "I'm not the spy. This bastard is. But I should ask, just out of curiosity: how do we know you're not just fishing?"

D'Offier said, "Veronica's the spy. But she has a point. If you already had evidence to convict, you wouldn't be having this conversation with both of us. You'd only be having it with the one you already knew to be guilty. So you don't know. This has got to be one huge bluff, nothing more."

I grinned at them both, aware that the excitement was showing on my face but not giving a damn that they saw it.

"I know that's the way it looks.

"But it's also where the game gets interesting.

"Because don't fool yourself. This is a game; a game of nerves.

"Literally. Outside this room, there are even bets being exchanged.

"You see, whether you choose to believe me or not, we absolutely do already know who's guilty.

"We know because I succeeded in reviving Tasha Coombs less than an hour after my superiors finished briefing me on the situation, and she told us everything.

"This offer's being made with her full approval.

"We make it for the most practical and cold-blooded of reasons, which is to say, the interest we have in preserving a potentially valuable means of streaming disinformation.

"It's our duty to make the offer, but that doesn't mean any one of us has to like it. Not Tasha, not me, and not her superiors—who as inhuman as they may sometimes seem, are also not incapable of feeling. They mourn the people who died because of this leak, fear for those who are still endangered, and feel damn angry about the attack on Tasha, in particular.

"They take what you've done pretty personally.

"I don't even like Tasha and I take it personally.

"So when I succeeded in waking her and the question of what to do with you came up, I pointed out that if we take what seems to be the natural next step and have Tasha march in here to confront you directly, you would know that we're not lying to you about what we have, and will have no choice but cooperation.

"But if *I*, an unknown quantity, came in here instead, you wouldn't have even the slightest idea what to believe.

"Wherever you go from here, defection or prosecution, it will be entirely as a result of your own actions.

"I argued that in the event that you did decide to cooperate, this would make you significantly easier to control; more in our hands, because you would then know you betrayed your masters out of conscious volition. And that if you didn't, we could take just as much satisfaction in knowing that you guessed wrong and therefore condemned yourself to a living hell.

"That's why we also arrested the one we know to be innocent, and made sure to hold both of you in the same room. Because, in this game we're playing, the guilty one will then inevitably harbor at least the ghost of a hope of getting through this unscathed, in order to make what will then turn out to be the very worst decision of a damned worthless life; one that will prove a torment, for every day the piece of garbage has left.

"I apologize to the innocent one. We all do.

"But I'm sure you'll appreciate the result."

I spread my hands, palms upward. "Sixty seconds. Hang yourself or not. I honestly win, either way."

Cheung and D'Offier stared, glanced at each other again, looked at me, and demonstrated the one thing I'd been hoping for all along: uncertainty. I saw more of it on one face than the other, who at the halfway mark decided to believe it and broke out in the kind of smile that is ordinarily only reserved for weddings.

At the ten second mark I announced that the time was almost up. The one who remained unsure fought a losing battle with confidence, faltered, and then (as I'd predicted), made the absolutely wrong decision, by remaining silent.

"Time's up," I said.

The door opened.

Tasha Coombs strolled in, crossed the room in four angry steps, and slapped the stunned Beau D'Offier in the face.

Tasha Coombs and Andrea Cort:

I didn't often drink in public. Public drinking implied a level of social invitation I didn't want to encourage; oblivion, when I wanted it, was best enjoyed alone. But every once in a great while, some obligation presented itself, and I found myself having to meet someone in places where human beings went to meet

other human beings; and when it did, I surrendered to the inevitable, often getting an early start so that the necessary interaction, when it came, felt less awkward and off-putting than it might have been otherwise.

By the time Tasha showed up, the room was ensconced in a comfortable soft blur. Then she came in, self-satisfied, chipper, not showing one ounce of the wariness she had long exhibited with me, sliding into the opposite side of the booth with the same kind of brightness she might have shown anyone who was an actual old friend. She was dressed for a night out and wore a light, sunny outfit a million years removed from the more forbidding shades she affected at work, and even further from the forbidding black suit I had worn from the office.

Eight days had passed since D'Offier's arrest, and I hadn't been able to put off her request for a social rendezvous any longer.

She said, "You look down. What's the matter? Are they not welcoming you back?"

I shrugged. The Judge Advocate's office was the way it always was. Bringen professing friendship while yanking my leash. Daily resistance to giving me a new assignment, based on how liberally I'd interpreted my last one. The sense, as always, that I was not a colleague but a fully owned spare part, wielded by a machine with no concerns over my comfort or well-being. I was used to it. But I was "down" enough, if down meant grim confirmation of what I'd always believed, that nothing would ever change. So I changed the subject. "And you?"

"You know I can't tell you everything," Tasha said. "But you-know-who is pretty much begging to give us all he knows. We'll let him stew a little bit longer to make sure he believes we intend on letting him rot. By the time we offer him his second chance, he'll be a puppy dog."

I took another sip. "That's good. But I meant your recovery."

She winced. "That image of you was refreshed so many times in those two weeks that it keeps popping up at odd moments, like when I'm trying to sleep. I don't mind telling you that it's difficult to even sit here talking to you, for more reasons than . . . what lies between us. But they say that'll go away. In the meantime, the therapy's taking care of it." She dipped her head to achieve eye contact. "But you don't look okay."

"I'm as good as I ever get, Tasha. I just need something to do. I may be off house arrest, but they have me doing busywork, stuff they should be assigning to interns. I don't know how long it will be before they deign to give a case again. I'm beginning to feel they may never."

"They will," she said. "Talent has a way of fighting its way out of the box. Or, if you're interested, a certain individual's change in fortunes leaves an opening in the division . . ."

I shuddered. "No, thanks." The last thing I needed was a career spent in a box, analyzing the data unearthed by others. I needed to be out where the problems were, dealing with them, being challenged by them, and most importantly, being distracted by them. I would, sooner or later, die without that stimulation.

Her drink arrived, and she kept up her end of the conversation for a while, talking about her own impending transfer to regular embassy work, her hope that this would give her more free time, a recent news story about a couple of space rogues whose attempt at a scam had just gone hideously awry.

I gave her one- or two-sentence replies until she finally ran out of starters to poke me with, at which point I finally said, "Tasha. What do you want of me?"

She didn't blink. "I wanted to thank you."

"There's no need. I just solved a problem that was put before me."

"And in the process returned me to myself."

"Something I would do for anybody, even a stranger. You want me to accept your thanks, fine, I accept your thanks. You're welcome. I'm glad you're better. But it doesn't make us friends."

She was still neither surprised nor perturbed. She just sipped her drink, gathered her words, and said, "Has it occurred to you, Andrea, that we've never really tried to be?"

"Oh, come on—"

She cut in. "I mean it. My own ego certainly contributed to the unpleasantness when we worked together, but you have to admit, I had a lot of help from you. And whenever we were not together, treating each other to the death of a thousand and one cuts, I always had other people to go to: friends, family, even a real lover who was worth the emotional effort. One of the reasons I'm transferring to

something not quite as all-encompassing is that these are all things I want to have again. But one of the things I knew about you then, and confirmed about you when I had to write that silly report, is that these are pleasures you've never let yourself have. This isn't just an intervention I owe you, Andrea. It's also something I want to be part of. I want to try. I trust you enough to think you can try, too."

I regarded her expression, which was direct and appealing, and as far as I could tell, sincere. This really wasn't a trap. This was a genuine overture. And the one thing I remembered about her, that still defined her for me after all this time, was that when she took on a project, she finished it. It was interesting, on an intellectual level, to consider just how she would tackle this one, if she had a chance.

Even so, I shook my head. "You're fooling yourself, Tasha."

"Am I? I know you read what I wrote about you. And you know that when it came down to my life, I did trust you."

"You trusted me," I said, "to solve a problem when it was put before me. You trusted me to see your chosen image, apply it to our experience together, and know exactly what your fail-safe must be. You trusted me to get the message you had sent. None of these mean that I can be trusted to change, or even that I might want to. I appreciate the offer, Tasha. But I'm not friendship material. And I'm not hoping to be."

I slid out of my seat, thumbed the credit pad to pay for my drinks and hers, and aimed myself at the door, but, given the cramped space between tables and the floor plan that required me to walk right past her in order to make my way to the exit, she had time to grab my wrist.

She looked more stricken than angry. "Come on, Andrea. This can be the way to something better. You don't have to always try so hard to make the world see you as a bitch."

I gave her a sweet smile before pulling my hand free.

"And yet," I said, filling my words with venom, "how extremely fortunate for you that it was the one word that best summarized our relationship."

She averted her gaze, and I made my way out. ■

Five Wagers on What Intelligent Life Elsewhere in the Universe Will Be Like

Steven L. Peck

We know a lot about life on Earth. Every year our knowledge of the other living things with which we share this planet expands by thousands of scientific papers. Our discoveries are amazing. Shocking. Blow-your-socks-off astounding. The one planet to which we have access never ceases to surprise and delight.

What about other planets? Can we extrapolate the version of life we find around us here to make claims about it elsewhere in the universe, especially intelligent life? Can we make some guesses about what we might expect a visitor from another planet to be like?

On Earth, we see commonalities among organisms, even among such wildly different creatures as insects and wombats. Certain adaptations consistently appear and reappear: legs to propel animals over the planet's surface; mouths and waste disposal orifices found on opposite ends to keep the two activities separate; brains located in the head; muscles attached to a skeletal system (e.g. grasshoppers are surrounded by a hard chitinous shell, while an otter's bones are found on the inside); and other generalizations of structures that allow things to survive. These common threads, which scientists call

morphology, exist because life is configured on this planet along particular lines, mostly due to the way that things shook out early in our evolutionary history, when Earth first began to crank-start the biosphere. The Cambrian radiation, as we call this explosion of life forms occurring about 543 million years ago, gave us all kinds of the attributes we find currently in Earth's creatures. For example, bilateral symmetry, wherein a creature's right half usually mirrors the left, has appeared in many evolutionary lines.

One can still see this structural history embryonically in the way most organisms develop from an egg or a seed. For example, humans develop from an egg into a many-segmented creature, like an earthworm than the soft, cuddly babies that eventually arrive. These segments appear in everything from insects to horses, and a whole lot of earthy types grow limbs on certain of these hidden segments. These structures fade in our more mature forms, but we all start the developmental process as segmented worms—structural remnants of our Precambrian ancestors.

Are these features necessary? In science fiction, we usually borrow heavily from the life forms we find here on Earth: arms, legs, tentacles, claws, eyes, mouths, mixing and matching the parts of creatures we recognize into novel combinations. This may or may not work as a way to conceptualize alien life, but we hold to a suspicion that these are at least possible constituents of life elsewhere in the Universe. Although many try, it is hard to imagine how very "other" these creatures from different planets might turn out to be. So we work with what we've seen before. However, alien structure could differ beyond our ability to envision. It could be non-DNA based life, or creatures that have adapted to life on Jupiter-like gas giants that evolve in ways that defy our wildest imagination.

Still, despite all the potential for a limitless array of wildly divergent creatures, I have a wager about what things are necessary for *any* sort of intelligent life to arise from the maelstrom of a planet's early chaos. Through things such as computer simulation models of digital life, we are learning things about possible organisms that seem to transcend our local biological instantiation of it. These might be thought of as "Life Universals," i.e., a likely set

of characteristics that any form of life might be expected to have across the far-flung outback reaches of the Universe.

So as an evolutionary biologist, here are my best guesses as to what an intelligent alien creature would look like. However, I am not going to define intelligent life too closely. I assume for the sake of this exercise that "intelligence" means that a creature from somewhere else in the Universe has reached the stage where it has similar reasoning skills, planning abilities, language use, and the potential for technological development as humans. This is a very human definition for intelligence, but that's the kind I'm interested in for this project. I'm not going to presuppose that they use DNA for their genetic code, or that they evolved on an Earth-like planet, or that their biochemistry is the same as ours, or that they exhibit any other details of our biology that make up the unique life found on this planet. Given those caveats, can we offer any guesses as to what they'll be like? The surprising answer is "yes."

Wager I—The creature will be the product of evolution

All life on this planet is the product of a lengthy evolutionary process. This will be true for our alien beings as well. There are three necessary and sufficient conditions that must exist in order for evolution to occur. First, there needs to have been variation in the traits that the organism, whether alien or Earthly, possesses. Whatever constitutes its way of life, evolution must have variation with which to work. One cannot look at the diversity of organisms without realizing that they vary. Even seemingly identical blades of grass, if examined closely, are different in subtle ways. So whichever planet our alien creature evolved upon, there must be a method of maintaining variation in whatever passes for the instruction set that makes new copies of this creature. For us, it is our genes. We can guess that our creature has something functionally similar. Not necessarily made from deoxyribonucleic acid (DNA), but something similar. Here on Earth, DNA has been the earthly chemical system of choice for creating life, but there are other possible systems. For example, some have suggested that silicon could replace carbon, or that arsenic could replace phosphorous. The most

fundamental requirement is that whatever chemicals compose life in the Universe, they must be able to carry and pass on information—so it is assumed that there must be a chemical “alphabet” to do that work. Scientists currently speculate that there might be polymers besides nucleic acids (like DNA and RNA) in the vast array of possibilities present in the Universe.

That said, however, DNA is a pretty darned good way to encode the instructions for making life, so it might be used throughout the Universe. Still, maybe not. We'll have to wait for more information from other places in the universe before we can answer such questions.

The second necessary element for evolution is a way of passing these traits on to offspring (they must have offspring, of course). If offspring don't resemble parents in some way, then what follows in the next generation is a random assortment of possible traits, and the survival of that generation is just a haphazard event relative to its environment. The ability to inherit parental features is a must for evolution.

Lastly, intelligent life will be the product of selection. The creature represents a line of organisms that have survived in a field of competitors that did not make the grade. It will avoid extinction while many of its contemporaneous evolutionary lines end in oblivion. So whatever environment our alien comes from, that environment has changed and been modified over the course of its planet's history. Consequently, the being's ancestors must have also changed and evolved into something that adapted to those changes. On any planet, there is a limited supply of resources, and that will constrain an organism's reproductive potential. Therefore, our creature's ancestors will have to have survived repeated bouts of competition with other creatures seeking the same limited resources. It does this by being better than its neighbor at getting the stores it requires to live. Our creature will be a survivor.

It may have survived using one of two typical ways organisms compete for resources. First, they might be really good at scrambling for it, like a warthog that tries to root out the succulent root before its neighbor does. Secondly, through ‘contest competition.’ This is

when organisms directly compete for resources, as when two rams smash their heads together to prove their superiority to the watching females. This is why we see an abundance of life forms that possess claws and horns, swiftly pumping legs, and lightening fast beak strikes. It is why there are colors to camouflage and entice.

The alien's ancestors must be the champions of resource competition. Which means of course that it will recognize what it needs to live and have superior methods of obtaining it. This creature's species will be the victor in many bouts of competition. No matter where it came from, it was a winner in the game of life.

Wager II—The alien will be a complex confederation of differentiated cells or cell-like structures forming organs that specialize in the different tasks of keeping it alive.

Over and over on Earth, we see the same pattern: cells have joined forces to divide up the labor in surviving the uncertainties of being a living thing. We know this happened when Earth life was just getting started, but one can see a radical example of this today in the Portuguese man o'war. It looks like a single creature—often mistaken for some sort of jellyfish—but it is really a multiple being. It is a bunch of individuals. It is a community of single organisms that specialize and cooperate to help the collective survive. Some of the individuals become stinging cells, others make up part of the air bladder that gives it buoyancy to float on the ocean's surface, and some will become reproductive cells. It is a unit of coordinated individuals, like an ant colony in which the individual players make up a greater whole, working together to get things done—not quite an individual organism but tending in that direction.

This appears to have happened over and over in our evolutionary history and is likely a key evolutionary mechanism for the appearance of increasingly complex organisms. We evolved from a single-celled creature, but we are now composed of multiple specialized cells of many kinds—including some hitchhikers like our mitochondria, an ancient kind of proto-bacteria that united with our cells long ago. The mitochondria derived some benefit

from joining forces with us in the game of survival. We liked the energy it produced for running our cellular machinery, and it probably relished being fed. It has been a mutually beneficial symbiosis.

So chances are that our visitor will be similar, with complex cellular division, reminiscent of our own bodily system, or a confederation of individuals uniting to become something more than the sum of its parts. The division of labor will allow the cell-like things to specialize into organs or subsets of individuals working on different tasks. All for one, and one for all, as they say.

This implies also that our extraterrestrial pal will be an individual of some sort. This is a subtle but important observation. The world is full of individuals: individual plants, individual animals. Why is that? Why doesn't one giant mass of ectoplasm cover the surface of the planet? It turns out that for life to develop, there must be individuals on which selection can act, and there must be a developmental process that creates that individual. This is the way evolution rolls. One humongous, living, oil-slick-like thing covering a planet could not evolve or adapt. The moment its environment changed, it would die or split off parts that could survive, hence individuals. This happens at many levels. There is a back and forth process between forces that create individuals and forces on a higher scale that bring individuals together to create a more complex emergent individual. Individuals emerge, come together, and form larger individuals—cells make ants, ants make colonies, etc. Humans are a prime example: cells make organs, organs comprise bodies, which in turn form families, that join into tribes, which constitute communities, which combine into social media mega conglomerates of artificial intelligence that . . . well, who knows where it will end.

This multi-constituted individual will have to go through a development process. Development is how organisms go from whatever carries its genes into a complete organism. To become the kind of individual it's going to eventually be requires its emergent

development from information-bearing materials. On Earth that occurs in a womb or seed and likely our hypothetical intelligent creature will do the same.

So my second guess is that the alien will be an individual made of multiple other individuals. Evolution will frame it to consist of differentiated parts that work together to create something unique and that will emerge from some sort of development process. It might be like the single organisms we are familiar with, or more similar to a Portuguese man o' war, or to an ant colony framing a looser confederation of individuals. Whichever form it takes, it will, like Walt Whitman, be able to cry out, 'I contain multitudes.'

Wager III—Our new friend's species will likely have sex

Sex turns out to be very useful. Not just for fun and poetics but also for maintaining the kind of variation that evolved creatures need in order to respond to the challenges they face in their local environments. However, sex is costly. When it comes time to pass selfish genes, if an organism could pass all of them on to the next generation, it would be so much more advantaged. By mating with another member of its species, a life form gives up a *half* of its genes—for what? It turns out that given the contingencies of survival, those that maintain loads of variation are more apt to survive the next environmental challenge—whether it is a new predator or parasite¹ or a shift in climate or whatever. If some of its offspring have the plasticity to respond to that new challenge, it is much more likely that they will be around next year.

Of course, some plants and animals abandon sex. This usually comes about in unusually unstable environments or in places where finding a mate is just too hard. Sex seems to be widespread enough, however, to warrant thinking it is an important strategy for surviving, and it has evolved on Earth several times. Mathematical theory also hints that two is about the right number of sexes. Even bacteria exchange genetic material in an event

¹ And wherever our new friend comes from, there will likely be parasites. When Thomas S. Ray created a digital ecology of creatures made of digital computer programs, one of the first things that evolved was parasites that hitched a ride with the other programs. Ray, Thomas S. 1994. An Evolutionary Approach to Synthetic Biology: Zen and the Art of Creating Life. *Artificial Life* 1:1_2, pp. 179-209

called transduction in which a tube erupts on the cell wall so that neighbors can shuffle genes with each other. Because of the advantage variation confers on a lineage of organisms, sex is flat-out a great idea.

In addition to the wondrous evolutionary benefits of sex, sex introduces new dynamics to evolution. Principally, things like sexual selection. Finding a good place to acquire some nice genes for an organism's offspring often becomes a competition among several individuals trying to attract a potential mate. Things like horns for combat and show, the male lyrebird's gorgeous tail, or even hairstyles in humans emerge to advertise the superiority of a genetic package. Because sex between two individuals requires that only one individual carry the offspring, male and female have differing biological strategies for achieving their shared interest in creating the next generation. Anthropologist Sara Hrdy² notes how females bear the brunt of caring for offspring while males typically (but not always) contribute less. This creates differences in the way the different sexes compete for resources and face the problems of survival. The dynamics of sex are vast, complex, and multivariate. A glance at the effects of sex on life on Earth boggles the mind; living things respond to the effects of sex diversely. So it is likely that during our creature's raucous evolutionary history it will discover sex as a way to maintain variation. As such, the same kind of complexity we find on Earth will inevitably be a part of his or her world (pronouns are probably appropriately used in that sentence as there will likely *be* a his and her depending on if they have just two sexes and who gives birth to the alien kittens—but do not underestimate the potential for alien weirdness when it comes to sex).

Wager IV—It will be engineered to be efficient in its environment.

Whatever our alien's nature, it will be well engineered to survive in its environment. It will have evolved in a particular ecology that will impose certain constraints on its shape and the way that it functions in the unique niches found on its far away planet. Depending

on what it is like back in its old neighborhood, the habitat there may select for a vastly different creature than anything we have here. However, it may also be that given constraints might pull its physical aspect toward something more familiar to us.

For example, look at the creatures that have evolved flight on Earth. If our alien comes from a place with an atmosphere that lends itself to flight, we can expect that wings might be a part of its trait repertoire. Flight has independently evolved at least four times on Earth. Flying insects may have emerged from nonflying creatures with big panel-like membranes on their back for heat exchange. These structures may have been attached to muscles to adjust their angle toward the Sun. Those muscles and membranes turn out to be useful for having descendants eventually able to take to the air, along with all the other precursors of body form on the insect's way to powered flight. Flight has also emerged three times in the vertebrates: in birds, pterosaurs, and bats. While each species evolved flight using different bones in their wings, i.e., with arm, finger and hand respectively, in each species, we recognize the common shape designed to conform to the requirements necessary for beings of the air.

We see something similar in the independently evolved aquatic species. Ichthyosaurs, dolphins, and fish all have a fairly similar shape, largely because the best way to move efficiently in water is using certain mechanical forms and designs. If something moves in water, it is liable to need fins, flippers and tails. Ask snorkelers. These kinds of evolutionary convergences are common. To live a fishy life, it is a good idea to look like a fish.

Another dramatic example of convergence comes from two voracious land predators both designed to take down large, lumbering Pleistocene megafauna, which independently evolved from rat-like ancestors. The first is the familiar saber-toothed cat. Lion-like, with stiletto teeth, it's engineered for taking the gigantic mammals that roamed the plains of the early American continent. The second evolved on the marsupial line (the line that contains things like kangaroos, wombats, Tasmanian

² Hrdy, Sarah. 2000. *Mother Nature: Maternal Instincts and How They Shape the Human Species*. Ballantine Books. New York, NY.

wolves, and such). The marsupial saber-toothed 'cat' looks superficially similar to the saber-toothed cat from the placental line. Here are two beasts that converged in form and function to a very similar shape—because they are animals that both emerged from ratty ancestors who hunted the same kinds of prey.

This means that on an Earth-like planet, we might find some very familiar friends. Cambridge Biologist Simon Conway Morris³ argues that the human shape might not be uncommon on a planet like ours with trees for evolving hands and savannah to help a creature to become upright. Could the *Star Trek* conception of humanoid aliens filling the galaxy be right after all? Klingons? Maybe. NuqneH!

So my fourth guess is that our alien visitor will have features that solve particular problems of survival in whatever environment exists on its planet. If it's an Earth-like place, we might even recognize some of the alien's structures.

Wager V—It will be a social species

If one makes a list of the intelligent species that have appeared on Earth, what does one notice? The list probably includes chimps, dolphins, ravens, elephants, parrots, many monkeys, dogs and wolves, and maybe even rats. To some extent these are all social species.

Sociality demands smarts. First, social species rely on information. Signals must be sent and interpreted—signals about where individuals stand in relation to others in the group. Social species are also usually hierarchically structured, and status will often determine access to the pantry and to the most desirable mates. This also requires the cognitive wherewithal to contextualize others, for example, "Where does that strapping male that just entered the troop fit in the eyes of others? Should I attack or make a pal?" A group member must recognize both who the other individuals are and where they stand in relation to it. It needs to be able to form alliances, distinguish friends from enemies, and retain a bright memory of who has helped and who has hindered it—so it can reward

largesse and exact revenge when necessary.

In Harvard biologist Edward Wilson's book, *The Social Conquest of the Earth*,⁴ he gives what he thinks is the minimal set for sociality to emerge in a species. First, groups must form (there must be something that defines the social unit). Second, the groups must be tightly formed. A group has to be more than a bunch of wildebeest standing in a crowd watching for lions. Wilson speculates that this requires a nest of some kind, for example, a place to bring food or secure enough to defend young offspring. A nest is not necessarily physical; for example, dolphins don't have a burrow, but they do seem to have the idea of which pod they belong to, a place to call home. (Maybe dolphins have a saying, "Home is where the pod is.") Then he adds that mutations must arise that maintains the group. This might be the development of a worker caste, as we see in the eusocial insects (eusocial from the Greek, true-social, is just this kind of system where there are reproductive individuals, like the queen in an ant's or bee's nest, with others who are sterile workers).

Part of what makes humans so bright is our use of language. Language allows us to communicate complex ideas, to pass these ideas onto our offspring. It allows us to carry out more complex plans, or to communicate the things we've learned over the course of a lifetime, e.g.: "Okay, here's how you carve a stone spear point, no, not that way. Look! Am I holding it that way? No. Hold it like this. Now, here's how you hunt. Got it? And here's how you cook it . . . roasted lightly in a sauce of mammoth milk and tarragon." Language also provides a way to imagine futures and ask "what-if" questions. If an intelligent species is going to develop a material culture (say that is capable of space flight), it had better be able to use language.

So my fifth wager is that our intelligent agent will understand sociality. It will be the product of a give-and-take social world and will understand both position and place within a society. I predict that it will likely even understand *our* social structure. If it wants to

³ Morris, Simon Conway. 2003. *Life's Solution: Inevitable Humans in a Lonely Universe*. Cambridge University Press, Cambridge, UK.

⁴ Wilson, Edward O. 2012. *The Social Conquest of the Earth*. Liveright Publishing Corporation, New York, NY.

place itself high on the social ladder, if an alien visited us it might say something like, "Take me to your leader."

So those are my five wagers on the nature of alien visitors. Not earth-shatteringly surprising, but all point to areas that are likely necessary for an alien to be as advanced as we are. Hayden Planetarium astronomer Neil deGrasse Tyson in his book, *Space Chronicles*,⁵ points out that astronomer Carl Sagan favored beneficial aliens who had survived the worst of human tendencies. This is quite possible. Today, we find that humans care more for the creatures and landscapes with whom they share the world. We have created the ecological crisis that faces the planet, yet we have become aware of that condition and can take steps to try to ameliorate it. There is growing consensus that we have a responsibility to maintain the habitability of our planet, not only for ourselves, but also for the organisms with which we share our world.

Neil deGrasse Tyson points out that, on the other hand, physicist Stephen Hawking thinks we will meet a species that will largely see us

as either a resource, or as something standing in the way of getting the resources it wants. This is also possible. What we find out there will have survived billions of years of selection that have demanded it be good at finding or taking the resources it needs.

Both of these are possibilities. Intelligent otherworld aliens might be philosophers or monsters, but I'm betting they will be evolved, complexly constituted by something equivalent to our cells, sexual, designed for a specific environment, and who are social in relevant ways. In short, much like us. ■

About the Author:

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⁵ deGrasse, Neil. 2012. *Space Chronicles: Facing the Ultimate Frontier*. W. W. Norton & Company, New York, NY.

Brigas Nunca Mais

Martin L. Shoemaker

I hadn't intended to spend our entire wedding reception talking about Captain Nick Aames. Really, I hadn't. But Nick has a way of working his way into events even when he's not trying to, especially events on the *Aldrin*, his ship. I'd be damned before I'd let him ruin our wedding night! So when Tracy asked a bunch of questions about Nick, I figured it was better to get them out of the way immediately, not later when we were alone.

It all started with the reception line. We stood just outside of the chapel, a small one by Earth measure, but a pretty large space by the *Aldrin's*, large enough for our sixty guests. The rest of the ship had watched by video. The ceilings were no higher than standard deck height, but the simulated wood grain and some creative use of lighting and pillars implied depth up there. Overall, the chapel felt spacious compared to the rest of the ship. It was decorated all in lilacs. Oh, not real ones, we didn't have the budget for that; but little purple silk blossoms were tastefully arranged on pillars and pews.

By contrast, the corridor outside was just another ship's corridor: narrow and function-

al and gray, though Bosun Smith had continued the lilac decorations out there. Tracy looked stunning in her dress—a white ensemble that practically floated in the quarter-gee of the *Aldrin's* main habitat ring. Her veil was clipped back behind her dark, elegantly styled hair, and her deep brown eyes were aglow. The corners of her eyes were lifted by a smile, and I couldn't stop staring. If I could see only one thing for the rest of my life, I would want it to be Tracy's smile. And if I could smell only one thing, let it be the lilac water she wore.

Like the rest of the officers, I was in white as well, my dress whites which never felt quite right to me: more like equipment than clothes. I was awkwardly aware of all the places where it didn't fit the way it was designed.

Then I saw someone who was perfectly comfortable in *her* dress whites; but then, she had been wearing them for a lot more years than I had. Admiral Morais, my former commander, had rearranged her schedule—literally for months—so that she could join us on the *Aldrin* as it swung around Mars. I was honored beyond words, and I beamed when she came up through the line. “Admiral.” I snapped a salute.

Morais returned my salute. "At ease, Chief Carver. You can relax for a day. You're off duty."

I relaxed as much as I could in full dress—maybe 5 percent or so—and I got Tracy's attention. "Tracy, honey, this is Admiral Moraes. I've told you about her. Admiral, my wife, Tracy Wells."

"Tracy Wells-Carver, Anson. Get used to that!" Tracy smiled more broadly, and I melted. (Would I ever stop doing that? I hoped not.) Then she hugged the Admiral, and I cringed. I wasn't sure how this fit with protocol.

But I needn't have worried. Moraes returned the hug, with only a slight reserve. If Tracy had breached protocol, Moraes was too classy to react. Instead, she just smiled back. "Dr. Wells-Carver. Delighted! I loved *Pioneers' Creed*! I can't wait to see your next documentary."

Tracy's smile couldn't get any broader, but I could feel how happy she was. "You've seen *Creed*?"

Morais nodded. "Tracy, everyone on Mars has seen it repeatedly. They've seen your whole series. You captured the real Mars experience."

"Admiral . . ." Tracy hesitated, very unlike her. "I'm flattered."

"You deserve it. When this affair is over, I would enjoy a chance to talk with you and Chief Carver in less crowded circumstances."

"Absolutely! I want to hear all the news!"

Then they hugged again, and the admiral, mindful of the crowd backing up behind her, moved down the line to Nick. "Captain Aames," she said. You would have to know Moraes well to detect the amusement in those words. She knew Nick hated formalities like this.

"Admiral." The captain and the admiral saluted, stiffly. While I greeted my guests, half my attention was reserved for Nick and the admiral. Nick clashing with the brass was as predictable as an orbit, but I hoped he would be on his best behavior for Tracy's sake. He had been reluctant to attend at all, only agreeing to be my best man after I had harangued him for weeks, but he had cleaned up nicely for the occasion. His red-gray hair and beard had been trimmed neatly, and his dress whites fit precisely, like he was

born in them. He was slightly short, but I almost never noticed that. Nick acted tall; he was a tall presence even around senior officers like Moraes.

"The *Aldrin* is a very fine vessel, Captain," Moraes said. "I see the new habitat rings are completed."

"Completed and half booked. It's getting a bit crowded aboard." Nick was proud of his command, but he didn't like many people. The more the *Aldrin* grew, the more he huddled in his black-walled office and let me deal with passengers and crew. "I would offer you an inspection tour, but—"

"Orbital mechanics waits for no man," Moraes replied with an old cliché of the space business. The *Aldrin* was on a cycler orbit between Earth and Mars and back. At each end, it made three swift, looping passes around the planet before zipping back in the other direction. The rendezvous windows were tight, and precisely timed. Not even an admiral's power could change those.

"Still," Moraes continued, "we'll have time for a fine reception, and for our dance."

Nick's face was stony. "I'll have to pass on the dance. It was bad enough Carver got me into this suit. Dancing wasn't part of the agreement."

The admiral shook her head. "I must insist. Protocol demands an Officers' Dance; and as senior officers present, we must set an example. Plus it would be good to test those legendary dance moves of yours."

Nick started to steam. "My ship, my rules. Pass."

The admiral's face tightened. She wasn't angry—not yet—but she was heading that way. "*My* gravipause, *my* rules, *Captain*." Nick's contract gave him nearly complete autonomy between planets; but when the *Aldrin* was within the gravitational zone of a planet, local rules applied. "Anson Carver is one of the finest young officers I have ever commanded, and I will see him shown the proper respect."

I tried to defuse the tension. "Admiral, it's all right, we don't need—"

But Moraes would have none of that. "It's *all right*, Chief Carver, because Captain Aames knows he's going to accede to protocol and my request. We *will* show proper respect to you and your lovely bride. And we'll do it without my having to make it a formal

command and an incident in his record, won't we Captain?" She stared directly at Nick.

I expected Nick to bristle even further at that. The only records he cared about were safety and mission objectives. Threatening his personal record usually made him laugh.

But Nick surprised me. He stared right back, never breaking the fiery eye contact, and answered, "As you wish, Admiral."

Tracy and I had twenty minutes of privacy between the receiving line and the reception: just enough to build up anticipation, not enough to do anything about it. Not properly, anyway. But we did spend five of those minutes embracing, kissing, and enjoying the anticipation. And the quiet! I had never imagined how chaotic a wedding would be.

But then Tracy pulled away. "Sorry, Anson, you've messed up my hair. I need to touch this up before we go in."

"Alllllll right," I sighed, "if you're sure you don't want to just sneak away to our cabin . . ."

Tracy giggled. "After the point Admiral Morais made about protocol, do you think we dare miss our own reception? She scares Nick Aames! She's certainly more than *I* want to tangle with. So let me work!"

Tracy started adjusting her hair in the mirror, and I stood back and gazed at her as she worked. Removing her veil and reaching for a brush, Tracy continued. "So Nick is certainly in an extra sour mood tonight, isn't he? I know he and Hannah had a messy breakup, but does that have to put him down on *all* marriage?"

"It's not marriage," I explained, "it's weddings."

Tracy paused. "Oh?"

"Hannah was his first marriage, but his second wedding. The first one was a disaster, and he's been sour on weddings ever since. He and Hannah ran off to a Justice of the Peace, and he had to get half drunk even to go through with that."

"A disaster? How bad could it have been?"

"Tragic, really. But Nick never talks about it, and it's not really my story to tell."

Tracy put her veil back on, adjusted it in the mirror, and turned to face me. "Oh, come on, Anson. Now that you've started, you know you're going to tell me eventually." She reached her arms around me; but at the last

instant, she jabbed her fingers into the ticklish spot beneath my ribs, and I jolted off the floor in the low gravity. "So you might as well tell me now," she said as I settled to the deck, "before I really make you jump!"

"Oh, you think so?" I grabbed her wrists, and I wished we had the rest of the night to ourselves. But we didn't. "All right, all right. But I wasn't actually there. This was before I ever served under Nick. This is just the story as Bosun Smith told it to me." And slowly, as the evening's celebrations played out, I started telling Tracy the story Smitty had told me about Nick. And about Rosalia.

Nick was a lieutenant in the Space Corps at the time, stationed at the new São Paulo Spaceport and overseeing component tests for L2 Farport. Smitty was a petty officer at the port; but the Corps was pretty new then, and fraternization rules were pretty lax. Smitty was . . . well, not Nick's friend—he didn't make friends easily even then—but a close acquaintance. And his occasional dance partner in the nightclubs of São Paulo. Bosun Smith is a large, outgoing, friendly woman—unless you make her angry, which I don't advise—and she has a way of dragging people out of their shells. In Nick's case, she did so through dance. I make jokes about Nick's dancing, but he's actually not bad, and very enthusiastic. It's one of his very few passions outside of his work. These days he only dances alone, and only in the privacy of his office. I'm one of the few people who has seen him dance in years. But back then, he had quite a reputation in the Corps.

Of course, Nick also had a reputation as a bit of a martinet. Oh, not like he is now that he's in command. He wasn't as moody as he is now, with his cabin all in black and him never leaving it except on duty. The dark moods came later, after all of this. But he was just as much a stickler for procedure and safety and attention to detail. He never hesitated to write up any infraction that he saw, no matter how small. But his first introduction to Rosalia, the new ensign at the port, was when *she* wrote *him* up.

Smitty was an Astronaut First Class then, attached to Commandant Birch as an administrative aide, so she was there for their first meeting, recording the minutes. She said Nick showed up just at the appointed hour,

summoned by the commandant to discuss his inspection of a cargo rocket bound for high orbit. He paid little attention to Rosalia, standing at attention along the wall. She was in perfect duty order, her long dark hair rolled up into a bun behind her cap, her blue Corps uniform neat and trim. Nick sized her up as a Brazilian local, correctly as it happened, and so he didn't consider her worth his attention. The locals in the Corps then had a reputation as token spacers, enlisted merely to satisfy Brazilian politicians, and expected to wash out before they ever saw orbit. Nick didn't know it then, but Rosalia was determined to shatter that reputation.

After Commandant Birch returned Nick's salute, he called the review to order, and he started asking Nick questions about the cargo rocket. Finally he got to the crux of the matter: "So on fifth May, you performed a readiness inspection on Cargo Rocket 54-17?"

"Yes, sir, I did."

"And you found eleven exceptions that caused you to issue a hold on preparation for launch?"

Nick glanced over at Rosalia. "I did, sir. I'm sure the ensign did her best to prepare the vessel, but—"

Birch interrupted Nick to say, "You are under a misimpression, Lieutenant. The ensign was not in charge of preparing the cargo rocket."

Nick suddenly felt warm under the commandant's gaze, but he chanced another glance at Rosalia. The corner of her mouth was turned up in just the hint of a grin. "Oh?" he asked.

"No, the ensign was in charge of the readiness inspection of *sixth* May. Ensign, tell the lieutenant what you found."

"Yes, sir." Rosalia stepped forward. "Sir, in addition to the eleven exceptions reported on fifth May, I found two loose safety covers on an environmental system."

Nick couldn't stop himself from interrupting. "That's impossible! Someone must have been in there between the inspections."

The commandant shook his head. "We have the access records. No one entered the rocket or the area between the inspections. And Ensign, what would be the consequences of these loose covers?"

"If I may, Commandant?" Birch nodded, and Rosalia pushed a simulation from her comp to

his desk display. The inside of the rocket appeared. "I simulated the most likely scenario. The covers would have shaken loose during launch—" The image started shaking with a simulated launch. "—and crashed around the cabin." And the simulated covers smashed back, bounced around, and broke instruments everywhere they tumbled. "The results would be tens of thousands of dollars in lost time and equipment."

Throughout her simulation, Nick had leaned over the desk. Occasionally he openly glared at Rosalia, as if enraged that she had the temerity to report *him*. But at the end, he shook his head. "Hundreds of thousands. Depending on which instruments were broken, possibly the entire payload." He straightened up and snapped to attention. "Commandant, I have no excuse. I await your discipline."

And then Birch actually laughed. "Relax, Lieutenant. We caught the problem. And we would have caught it before launch, regardless. You had so much to report, you just lost track. This will go in your record, and that will gnaw at you: a blemish on your spotless record. That will be enough to make you twice as careful in the future. Dismissed, Lieutenant."

As Nick turned to leave, he stole one more glance at the young ensign. This time, with Nick blocking her from the commandant's view, she openly grinned at him.

The incident became a mark on Nick's record; but in the eyes of his fellow lieutenants, the mark on his reputation was even larger. No one had ever caught Nick in such a large mistake before. No one had *ever* made Nick back down. But the new ensign, a local girl who had worked her way into the officer ranks of the Corps, had done both in one day. In one move, Rosalia had become Nick's rival for the top officer at the port.

Nick had been dead wrong; he'd been caught, and he took his lumps. As you might guess, it motivated him to be more careful in his own work, but it also drove him to be more ruthless in his reviews of others. Sure enough, about three weeks later he found something to report in Rosalia's work. It was a minor thing, Smitty didn't even remember what it was, but Rosalia took her lumps better than Nick had. She was always much more good-natured than him. Sometimes that made

her a little sloppier, but it made her easier to deal with as a person.

And then the inspections became almost a game for them, tit-for-tat reporting on each other, but a game with strict, fair rules: they only reported legitimate infractions that actually belonged on a report. They never made up anything just to score points on each other. Their commanders were amused, but also annoyed, because the infractions they reported became a paperwork nightmare. Also, the game became frequent fodder for the rumor mill, and a few joked that Nick and Rosalia should just get a room already. But most assumed it was rivalry, not romance, the two of them bucking for promotion—Rosalia earned lieutenant in record time—and each seeing the other as the most likely obstacle in their path.

And they were probably right, up until that night in Porco Cego, a nightclub near the hotel where many of the junior officers stayed. São Paulo was a pretty small port then, and there was a shortage of on-base housing, so junior officers and senior enlisted were encouraged to find billets nearby. Smitty had a room there, too, and she said it was a great way to meet the locals, particularly at dance clubs like Porco.

That night, Nick was cutting moves on the floor, drifting from partner to partner and dance to dance. Smitty says he was in a rare, relaxed mood, enjoying the release of just moving to the music. Locals and Corps, he danced his way through them all.

Then a beautiful, graceful, dark-haired Brazilian woman tapped him on the shoulder for the next dance. It took two takes for Nick to recognize Rosalia, out of uniform and hair down around her bare shoulders, decked out for a night of liberty.

"What do you want?" Nick asked in his usual blunt fashion.

Rosalia laughed. "If you don't know, then you're probably too thickheaded to keep time, but I'll give you a try anyway. Dance, Lieutenant?"

Nick started to turn away, but he turned back and looked her over, her golden skin set off against a sleeveless blue peasant blouse and a flowing white skirt. He shrugged. "Oh, what the hell? I've danced with everyone else tonight."

And then, Smitty says, magic happened. Between Nick's enthusiasm and Rosalia's grace, they made the perfect partners: swinging around the floor, changing steps and styles with the time changes as if they could read each other's minds. They anticipated every step, every spin. Smitty thinks it was another form of testing each other, challenging and assessing each other, and they quickly learned what they could do together, daring themselves to new heights with every song. There was no more trading partners that night; Nick and Rosalia had found their partners. They finished with "Brigas Nunca Mais," a slow, languid, romantic tune that's great to listen to but nearly impossible to dance to. The tempo's just wrong: not quite a fast song, not quite a slow dance. But they did it, turning it into a sensual mix of pulling away but not quite out of reach, drawing swiftly together as if tugged by a gravity well, and then spinning slowly around, locked in each other's arms. When the music finally stopped, the onlookers applauded.

Smitty tells me that Nick never made it back to his hotel room that night, the first time that had ever happened. But it became a pretty regular occurrence after that.

Though the reporting game continued, the tone changed, at least for Rosalia. It became more about giving Nick points that he could work off on the dance floor. But for Nick, it remained as serious as ever, and eventually Rosalia realized: this wasn't a game for him; it was rehearsal for the most deadly challenges imaginable. Yes, that's exactly what it's supposed to be. They drill that into us so we can't forget it. But that message struck Nick more deeply than it did the average astronaut. Obsessively, you would have to say. And so he kept right up on every smallest infraction, every smallest detail, reporting them with that cynical, critical view he has.

Mind you, Nick wasn't being an ass just for the fun of it. L2 Farport, the jumping-off station at LaGrange Point 2 beyond the Moon, had recently been approved by the System Initiative, and everyone knew they would be staffing construction crews in the near future. São Paulo started receiving a lot of visits from brass and diplomats, and everyone assumed the teams there had a good shot at L2. Nick

made no secret that he planned to turn that good shot into a sure thing.

Even though Rosalia agreed with Nick in principle, and even though she wanted the L2 assignment as much as he did, she grew annoyed with Nick's obsession. She decided she wanted to find Nick's fun side, somehow. On the dance floor, out on the town, in bed . . . She wanted to lighten him up, to show him he could enjoy life and still live within regulations, still advance his career. One night, desperate, she took it a little too far. She always did take more risks than Nick. That night, after Nick fell asleep, she logged into the hotel computer and cancelled his morning wake-up call.

Smitty says that she heard the consequences the next morning from three rooms away. "You did *what?*"

"Lighten up! It's not like you have important duty today!"

"It's *duty*! It's *all* important! People rely on us! The brass are *watching* us! I've got twenty minutes!"

"No problem! You woke up even without a call."

"I woke up fifteen minutes *late* without a call!"

A door slammed, and Smitty heard Nick's running feet in the corridor outside. She says that morning's report showed Nick at his post on time—but out of uniform in three particulars, a record for Nick.

Outside of official duties, Nick and Rosalia didn't speak to each other for five weeks after that.

And Nick was miserable! You'd have to know him well to tell the difference between Nick's usual acerbic manner and his new bitterness, but Smitty said it was unmistakable if you knew the signs. It was the difference between a gleam in his eye as he pounced on a mistake, versus a frown and a tone in his voice that indicated despair that anything would ever be right. He even stopped talking about L2.

Finally Smitty and some of the other trainees took matters into their own hands. A brash move, perhaps, but they hoped to get Nick to let up on them just a little. Plus, I've always suspected Smitty was a closet romantic under her party-girl exterior. She showed up

at Nick's hotel room one night, dressed for a night on the town. When Nick answered the door, she smiled and asked, "Join us for liberty, Lieutenant?"

Nick shook his head, face turned down. "Not in the mood, Smith. Pass."

Nick moved to shut the door, but Smitty held it open. "Come on, Lieutenant. It would be good for you to bond with your team a bit. You know the L2 selection committee puts a high value on unit cohesion."

Nick glowered. "Who cares what the selection committee thinks?"

"Begging your pardon, but you do, Lieutenant. You've just forgotten for a bit."

Maybe Smitty was convincing, or maybe Nick was just in a mood to be convinced, but he went along. Once at Porco Cego, she wheedled Nick out onto the dance floor for a few numbers, but he was sulky and unenthusiastic, just going through the motions. Finally Smitty made her move: when a new song started, she grabbed Nick's arm and spun him around. Behind him stood Rosalia, equally trapped by Ensign Matsuura. "Sorry, Lieutenants," Smitty said, "but you two need to talk. For the sake of unit cohesion." And she backed away, sure that Nick and Rosalia couldn't avoid their overdue confrontation.

And if you believe that, you don't know Nick Aames! Without a word, he stalked off the floor, through the bar, and out into the warm Brazilian night.

But as stubborn as Nick is, he had met his match in Rosalia. While he pulled away, she determined to draw back together, whatever it took. She chased after Nick. Smitty and the others had the good sense not to follow, but they heard the shouts from outside, even over the music. They were sure Nick would be an absolute terror in the morning, and they wondered how badly they had screwed up.

Then, just as they were imagining the horrors of their next duty shift, they noticed the shouting had stopped. And the music had stopped. Rosalia was crossing the dance floor, storming for the exit and her home, but Nick was up at the DJ stand, handing over a credit chip as the DJ swapped songs. Rosalia slowed when she heard the opening guitar notes of "Brigas Nunca Mais," pausing just long enough for Nick to dash across the floor, grab

her hand, tug her back to his arms, and twirl her into a blur of hair and skirt and flashing limbs. They spun around each other, pulling closer and closer until they clung together as one. As the song trailed off, they leaned in for a kiss. The song meant *Fight no more*, and that was the effect it had. That dance, their song, those always drew Nick and Rosalia back together.

"But Anson, what about the wedding? I still don't see Nick's problem here."

I had a panic impulse to hush Tracy—probably not the smartest move on our own wedding day. I looked around and was grateful that Nick was nowhere in earshot. We were in the corridor outside Assembly Deck, waiting for Bosun Smith to formally announce us to our reception within.

I lowered my voice and hoped Tracy would follow my example. "You can't really understand what went wrong with the wedding without understanding how they got there. Trust me; Nick and Rosalia's relationship was a tangled knot from the start, and the wedding disaster was a consequence of that.

"But for a while, things were knot-free. After making up on the dance floor, Nick *did* lighten up. Smitty says you wouldn't recognize him. Instead of his cynicism being locked on all the time, it was like a rheostat that he only dialed up when he needed it to make a point. The rest of the time, he almost gave up his snide remarks, as if the world suddenly measured up to his expectations. Smitty even saw him smile at odd times for no reason at all. Rosalia made him a different man, she said, a *complete* man like he never was before. Or since."

Tracy smiled wistfully. "I think I'd like to meet that Nick."

"So would I, my love, so would I. But I fear that Nick is dead."

Just then, I heard Smitty's voice boom through the door: "... Chief Anson Carver, and Dr. Tracy Wells-Carver!" And the door opened with a roar of polite applause. We went into Assembly Deck and into our reception, but throughout the night, whenever a private moment presented itself, Tracy pressed me for the rest of Nick and Rosalia's story, starting with how they went to orbit.

* * *

The reporting game continued in earnest, and it had one more side effect: it brought up the performance of their entire unit. You've seen how Nick is: he drives away or breaks or pisses off anyone who can't measure up to his standards, but the ones who remain, even if they don't like him, are prepared for any challenge. The entire unit got better, with individual and unit commendations far above the norm. They supervised preintegration testing of the L2 environment units; and they found and diagnosed so many problems, they practically bankrupted the supplier. That caused a construction delay, but it also saved lives *and* schedule in the long run.

So it was natural that, when the time came to staff the construction team for the L2 Farport, a large contingent were selected from the São Paulo Spaceport. Smitty made the cut, even though she was more junior than command was looking for, because of recommendations from both Nick and Rosalia. Anyone who thinks that was a matter of personal bias doesn't know Nick.

What followed was eight months of mission training in simulators and neutral buoyancy tanks, Nick and Rosalia both driving the team to the highest marks on record. Then came the blast off to orbit, transfer to Luna, and then finally a transport out to LaGrange Point 2. When the transport delivered them to the L2 construction site, those demanding standards really began to bear fruit. Sixty thousand kilometers beyond Luna, with nothing around but temporary habitats and the growing shell of Farport, the team had to rely on each astronaut getting each thing right. Captain Leeds was one hard-nosed son of a bitch, as bad as Nick in a lot of ways, although for him schedule and budget were as important as safety and detail. He had a timetable; he had a spending target, and by damn, he was going to hit them! He drove the construction team harder than any downside officer ever had; but he seemed to have an internal micrometer that could measure precisely where the team's breaking point was, and then he stopped just short of it, before stress would make them sloppy. Accidents would cost him valuable, trained personnel and untold lost time and money. So though Nick was never as concerned about the budget, he worked well with Leeds. Soon he had a promotion to

lieutenant commander, and he was on Leeds's advisory staff. They often clashed—this is Nick we're talking about—but Captain Leeds appreciated Nick's independent voice and his focus on the mission. Nick also got command of one of the four construction shifts.

Farport then was just a hint of what it is today. The Prime Module was there, of course, the original construction platform that served as their habitat and base of operations. It has the massive engines they use for occasional orbit corrections. The Prime was mated to the long docking axis, but the axis was still only a framework—not closed in yet—and they were just starting to assemble the first habitat ring. You would need a lot of imagination to look at that skeleton and see Farport today, with its growing stack of habitat rings and the new extensions added every year. But even then you would see a lot of traffic: suited astronauts, one-person construction hoppers, and the larger Mobile Platforms that served as ferries and transports between the docking and assembly points and the port itself. A lot of modules were assembled far from the port, so that stray parts or any other problem couldn't threaten the port itself. Then the hoppers would grapple and tug the modules to dock with a Mobile Platform, and the MP would ferry it and maneuver it to attach to the port's skeleton.

Soon Rosalia had command of another construction shift. She got along with Captain Leeds, of course. She was always more in touch with the human side of the Corps. When Leeds wanted an opinion on whether he was pushing the crew too hard, it was Rosalia he asked. He knew she would have a better read on crew morale, and morale mattered to him, because it could affect their performance and his timetables.

Morale-building was actually a line item in Leeds's schedule, and in his budget. So as soon as the first habitat ring was spun up to one-quarter gee, he announced a gala in celebration. It wasn't much of a gala by Earth standards, not even by the standards of our wedding here on the *Aldrin*, but for a weary crew of astronauts stationed at humanity's farthest outpost (at the time), it was a much-needed chance to unwind and cut loose. And to explore the possibilities of dance in low gravity! That was something only old Luna hands had experienced before then, and neither Nick

nor Rosalia had served there, so this was a new challenge for them. You know the Coriolis Catch, that move we can never get right? You can't do that move on Luna, can't do it anywhere but a spinning habitat. I'm supposed to toss you so high that the Coriolis effect takes over, so you'll land somewhere downspin; and then I slide across the deck on my knees and catch you when you land. My knees still ache from the last time we tried. Well, Smitty claims Nick and Rosalia *invented* that move at that gala, Nick catching her and wrapping her in his arms as if they'd practiced it all their lives. Then they would hold that embrace through the end of the song, as if trying to make that moment last forever.

The gala wasn't the only place that Nick and Rosalia danced. With habitat ring 1 spun up, Leeds was able to accommodate a larger construction crew, so all of the schedules and assignments got reshuffled. Rosalia was assigned as lead hopper pilot on Mobile Platform 1, and as second in command of the construction project, Nick was the pilot on MP1. If it had been the other way around, it would've never worked; Nick wouldn't have been happy going from a shift commander to command of just a hopper squad. But Rosalia loved to pilot above all her other duties, and lead hopper pilot was enough command to satisfy her. And when they worked together, she and Nick turned her hopper and the Mobile Platform into a delicate duet, each anticipating the other's moves, launching and rendezvousing with unparalleled elegance. Given their relationship, a few in the Corps grumbled about the two of them working so closely together and in two such prime positions; but their efficiency ratings were absolutely top-notch, so Leeds left them where they were. Later he would come to question that decision.

Working the same shifts and in a small, remote station, Nick and Rosalia became closer than ever. Smitty didn't think that was possible, but they became almost of one mind on most things. Oh, they still clashed sometimes, and some of their shouting matches were legendary, but it was always about the safest, most effective way to perform the mission. And once one of them was clearly proven right, they united again to carry out their decision with utmost precision, as if the shouting

had never happened. They never really reached *fight no more*, like they did on the dance floor, but they had found a way to fight only over what mattered, without losing what *mattered*.

So no one was too surprised when Nick and Rosalia showed up one day wearing matching gold rings, each on the right hand in the Brazilian engagement tradition. With boost costs as high as they were, it had probably cost Nick as much to lift those rings up from Earth as the rings themselves had cost—a few months' pay all together. But Smitty says the sparkle of the gold matched the sparkle in Rosalia's eyes. Like I said, she's a closet romantic. She really believed Nick and Rosalia were fated to be together. If only she had been right . . .

"Anson, don't you *dare* think you're going to stop there!"

"*Tracy!*" I whispered, putting down my napkin. "They're about to call us out for our first dance."

"Good! It's a long, slow song. You can whisper in my ear, and no one will be the wiser."

"But . . ." I hesitated. "You know I'm a lousy dancer. I have to concentrate, or I'll be all over your feet."

Tracy giggled. "Sorry, hon, but you're all over my feet even when you concentrate. It's okay, it's quarter-gee, my feet can take it. Now tell me about that wedding."

I glanced over at the Officers' Table. Nick seemed to be in some argument with Admiral Morais—a polite argument, but I could see fire in his eyes again—and I figured he wouldn't hear. So I continued. "Rosalia chose a wedding date to fall within the Grand Opening ceremonies for Farport. The System Initiative had scheduled a week of celebrations to mark the port's opening to civilian personnel, researchers, and tourists. The wedding wouldn't be the opening night, of course, or the closing night. Those were slated for massive diplomatic/public relations parties. But Captain Leeds had grown quite fond of Rosalia. He said she reminded him of his daughter. He also said she was an excellent officer, and too good for Nick, but he pulled some strings and arranged for the wedding to take place on the second-to-the-last night, when there would be plenty of brass and friends to attend. He even agreed to officiate.

"In the end, maybe that was the mistake. Maybe they tried to cram too much celebration and too much work into too little time. Maybe if Nick and Rosalia had scheduled their wedding for later, everything wouldn't have gone so horribly wrong . . ."

Or maybe not. So many small things had to go wrong to create the disaster. Afterward, despite his pain, Nick dispassionately documented every one of them, defining causes and assigning blame in an incident report that is still taught in the academy today as an ideal after-action report. But even Nick couldn't have foreseen everything that went wrong. It had started nearly sixteen months earlier, at Darwin spaceport, when a technician transposed two digits while setting up a test for a fuel injector. The injector was tested at more than twice maximum pressure, and it developed a hairline crack. But because the readings all fit with the transposed digits, the test "passed." So the injector was certified and placed into inventory on Superorbital Transport *DeMarco*, and there it sat in a parts locker for sixteen months. But when the *DeMarco* was bringing a contingent of System Initiative bigwigs and other civilians up to Farport, there was a fault in the starboard engine. The *DeMarco's* engineer, showing admirable caution under ordinary circumstances, chose to overhaul the entire starboard engine while they were coasting to their next burn. She was absolutely correct per maintenance protocols, but in the process they installed the faulty injector. The unit lasted through initial testing and course correction burns, but when the *DeMarco* went to a full burn to settle into a matching orbit with Farport, the vibrations caused the cracked valve to break wide open. The ignition chamber flooded with far too much fuel, and with a horrifying *WHUMP*, the entire starboard engine blew out, venting gasses and causing the ship to spin. The port engine automatically adjusted to compensate, but not enough. The *DeMarco*, crippled and tumbling, sped ahead on an altered trajectory. They couldn't make orbit, and they couldn't return to Earth. All they could do was fly deeper into space and hope someone was in position for a rescue.

And fortunately, someone was. Even though they had a wedding scheduled in less than

twenty-four hours, Nick and Rosalia and their MP1 crew were on duty, picking up modules that had been dropped by a cargo rocket. They had insisted on keeping up with their work right up to their final shift before the ceremony. So when the SOS went out from the *DeMarco*, Nick got on the comm. "Transport *DeMarco*, Farport Mobile Platform 1, Lieutenant Commander Aames commanding. We're in your neighborhood. What's your vector?"

The comm screen lit up, and a young, blonde female astronaut appeared. "Mobile Platform 1, Transport *DeMarco*, Captain Austin commanding. Our vector is still changing. We're trying to use our remaining engine to get control. Sending our control feed now."

A blinking light on Nick's console told him the feed was connected. He looked at his navigation screen and nodded. "*DeMarco*, MP1. Affirmative, we have your feed. Nav comp says it's tight, but we can catch you if we start immediately. My computer and yours will work out the approach maneuvers. What's your situation, Austin?"

"MP1, *DeMarco*. We're shaken, Aames, but surviving. We have six crew, ten passengers. No casualties, but the erratic boost led to some injuries. Our chief engineer suffered some nasty burns while ejecting the damaged engine. And I think the engine may have ruptured our O₂ lines. We're losing pressure, not fast, but steadily. The assistant engineer's suiting up for an outside inspection, but he doesn't sound very confident."

Nick took his thumb off the comm switch long enough for a quick, "Damn." Then he thumbed the switch again. "*DeMarco*, MP1. Understood. I'll tell the computer to prefer a fast pickup. MP1, out." By that time, the nav comps of the two vessels had worked out a solution. Without a load to haul, the Mobile Platform had power to spare. It wasn't graceful, but it was fast. Nick punched the EXECUTE button, and MP1 started boosting for the *DeMarco*.

Then he switched over to his command circuit. His hopper team was deployed, and he didn't have time to wait for them. "All hoppers, MP1. As you've heard, we have to make an emergency rendezvous and pickup with the *DeMarco*. I've already started a low-thrust course for them. As soon as you all dock, I'll switch to high-thrust and catch that transport.

So if you don't want to get stranded in the cold, boys and girls, vector on me and haul ass. Burn your tanks to empty if you have to, but I can't wait around for you. You're going to have to catch me. Signal your approach solutions."

And Nick watched as the hopper status screen showed solutions coming in: Hopper 6, Hopper 3, 4, 2, 5 . . . but not 1. Nick switched to Hopper 1's channel. "Hopper 1, MP1. Where's your solution, Rosie?"

It took several seconds for Rosalia to respond. "MP1, Hopper 1. I can't work a solution. Recommend . . . you proceed without me."

"Nonsense! Burn the tanks dry. You've got enough fuel to catch me."

"Nick . . . No, I don't."

"What?"

"Nick, I didn't . . . I didn't refuel on my last docking. I had plenty in my tanks, more than enough for our pickup schedule. I just forgot."

"You *forgot*!"

"Remember, you called, just to talk. And then the caterer called, a problem with the dinner menu. By the time I worked that out, there was no time for refueling. I was still within safety margins, on the low side, but within. So . . . I'm sorry . . ."

"Sorry?" Nick fumed. "Fine. I'll wait for you. I'll find another intercept solution."

"Nick, you can't. I've worked the numbers, by comp and by hand. Orbital mechanics waits for no man, Nick. Or woman. If you don't keep boosting, you'll never catch them; and *you'll* run out of fuel trying!"

Nick paused and ran some numbers of his own. "Okay, I'll jettison some oxygen tanks. That will lighten my load, make me faster, and then you can pick up the tanks and have enough air for a rescue."

"Nick, *you can't*. With sixteen more people on MP1, and with their own O₂ leaking away, you're going to need every kilo of air you have. It does no good to rescue them if you all suffocate from CO₂ buildup. Now go!"

"Rosie, I can't leave you out here to . . . to . . ."

"One of me, sixteen of them. No choice, the numbers don't add up. Now go get them, *Lieutenant Commander Aames*."

Nick worked at his computer furiously, looking for a solution, his frown deepening as every second pulled him farther and farther

from the hopper and his bride. Finally he smashed his fists against the keys several times. When he looked back at the comm screen, Rosalia was shaking her head, tears in her eyes. She whispered, "Go get them, Nick."

Lost for an idea, Nick just stared at the screen. Finally, his voice choking, he said, "*Brigas nunca mais*, Rosalia."

Rosalia answered, "Nunca mais, Nick." And she cut off the comm screen.

"So she *died*?" I saw tears welling up in Tracy's eyes. "On their wedding day? Oh, poor Nick . . ."

As Tracy had asked, I'd continued telling Nick and Rosalia's story right through our first dance as husband and wife. She had gotten caught up. Like I said, Nick has a way of ending up in the middle of everything, even when he's not there. Now in the middle of the Officers' Dance, with all my superiors and peers circling around us like a sea of white, Tracy had insisted on more.

I shook my head. "Died? Oh, no. Nick made some quick mass calculations, came up with one more wild idea, and made Leeds see it was the only option. Leeds detached the Prime Module from the docking axis, and freed of the mass of Farport, those giant engines made Prime into one hellaciously fast rescue craft. It wasn't efficient, but by burning fuel like they were giving it away, they found a solution where MP1 could hold up for Rosalia, reach the *DeMarco* before they ran out of oxygen, *and* make rendezvous with MP2 when it launched from Prime with enough spare fuel to bring both platforms back. Then Leeds brought Prime around and back to Farport, tanks nearly empty. The docking was rough, it shook the whole port; but mostly thanks to Nick's determination, everybody lived."

"But then—"

"And then the wedding had to wait. It took two weeks of double shifts for all crew to stabilize the port and correct all the orbits. And then another five weeks for Nick and an investigative team to prepare that marvelous after-action report. And by the time that was done, the wedding was off."

"But why?"

"Because in that incredibly detailed report, alongside the tally of millions of dollars lost

due to overtime and structural repairs and expended fuel, alongside the point-by-point enumeration of the direct causes of the incident and the parties to blame, Nick included a thorough list of secondary causes; and at the top of that list was Rosalia's failure to perform basic maintenance due to distraction by personal issues. Second on that list was his own personal call that was a direct cause of her distraction. They both got summoned before the Review Board to answer charges."

Tracy paused and glared at Nick as he gracelessly suffered through the Officers' Dance with Admiral Morais. "That . . . bastard!"

I shook my head. "I like to think of him as a calculating bastard. He calculated that he could lose her by following the rules, or he could risk *really* losing her someday by letting up on the rules. He couldn't face that again. His way, she would live. She would hate him, but she would live."

Tracy frowned, trying to see things through Nick's eyes. "But then what happened to her?"

"At first, there were some who used the incident to dredge up the old prejudices about Brazilian astronauts. I hear Nick got into a few fights trying to quash those rumors, but the rumors stung Rosalia, and she took them personally. She was *hurt*. But after the Review Board confirmed every one of Nick's conclusions—and after Nick himself suffered a demotion as a result—Rosalia eventually, grudgingly, saw that it wasn't personal. She was still angry at Nick, but she moved on and grew from the incident. And she realized that her career wasn't completely washed up. She could still make Brazil proud of their native-born astronauts. So she took her lumps and then threw herself into her work with a nearly Nick-like zeal; soon she got her rank back, and she rose up through the Corps, proving herself to be the fine, dedicated officer Captain Leeds always told her she was. One of the finest officers in the Corps."

"But did she ever forgive him?"

The music stopped, the officers started to clear the floor for more guests, and I shrugged. "No one's really sure. Some people say yes, some no, but the two of them . . . Well, at least in public, they act like none of that past ever happened. Like they're practically strangers." Then I heard the opening guitar notes of a familiar Brazilian love song. Smitty up to her old

tricks, no doubt. I turned Tracy around. "But you'll have to judge for yourself."

Admiral Morais stopped, her back to Nick, and with one quick move, she let her hair down in a distinctly nonregulation fashion. There was some gray in it, but it was mostly still the dark hair of the young lieutenant, and it still flowed in the low gravity. As the music picked up, she pranced lightly away from Nick, but one hand trailed behind her, beckoning. Nick leaped after her, clasped her hand at the last moment, and drew her gently back into his arms and a twirling, laughing embrace.

The other dancers, seeing two true *artistes* at work, yielded the floor to watch them move, and for three-and-a-half minutes, Nick and Rosalia whirled around the floor as if twenty years had never passed. She fled, and he pursued. He ignored, and she enticed. They circled each other like two fighters, looking for weakness, and then they embraced and twirled, stronger together than when they stood apart. And they clung to each other, swaying and leaping in the low gravity as if they were one.

And just like on Farport, they reached the climax of the music when Rosalia ran and

leaped at Nick, and he sidestepped, turned, caught her at waist and thigh, and propelled her higher, so high that the deck of the *Aldrin* spun beneath her, carrying her downspin. Her hair streamed behind her like a triumphant banner. And Nick continued his step into a leap of his own, a downward leap ending with him sliding across the deck on his knees. His face shone with a light I had never seen there before as he slid to a halt almost in front of Tracy and me, exactly where he had to be to catch Rosalia exactly when she needed him to catch her, and he folded her into a loving, protective embrace. The guests rose to their feet in thunderous applause.

But from our place right next to Nick and Rosalia, Tracy and I saw what the other guests couldn't. Nick bent in to kiss Rosalia, but the admiral turned her face away, shaking her head. *No*. I saw the light fade from Nick's face.

Without missing a beat, as if nothing was wrong, Nick rose with her still in his arms, and he set Admiral Morais back on her feet on the deck. Then he snapped a salute, and without waiting for a response, Nick Aames stalked back to his dark, empty office. ■

Robot Boss

Erick Melton

Don Donalson looked at the production sheet in the A-bot's manipulator. He reached out and took it as if it might explode.

"So . . . ?" Don looked up at the A-bot's bulbous head and its bulging camera eyes. There was a small screen between them. Right now, it displayed the logo of the company they worked for: North American Legal Services. "The CD I attached to this order earlier . . . it's been misplaced?"

"That is an incorrect interpretation." The NALS logo disappeared. The face of an animated chimpanzee, Cue, the avatar for the production department, appeared in its place.

"There was no media storage device attached." Cue beat its chest and snorted into the small screen. They even added a special effect of his snort fogging the glass. "Locate the missing storage device as soon as humanly possible." The A-bot spun on its hemispherical base. It moved off toward some other task.

Don sucked on his teeth. "As soon as humanly possible," huh? How about you find it as soon as "robotly" possible? Don knew he'd attached it. It stuck in his mind because of how long it had been since he'd held an actual CD.

No point in telling that to Cue, though. Don sighed. Everyone knows, the boss is always right.

Don sat across from Sunny Tomaschewski in the break room. She was twirling a long strand of her henna-red hair around her index finger. It was her "thinking" gesture.

"So-oh . . ." Don braced himself. Sunny turned single syllable words into two when she was going to say something that could be taken wrong. "You didn't . . . leave it on a work table, or set it on a processor, or something?"

Don sighed. Sunny was a good girl. A good worker. She was from the generation that followed Don's. They had less trust in anything a human might tell them.

Sunny let go of her hair and leaned forward. Hands pressed flat against the table. Ample bosom creased by the table's edge.

"I'm not saying you're lying or anything. It's just . . ." She wrinkled her face, then gave up her effort to finish the sentence. "Why didn't you have your lifelog on?"

"Cue doesn't allow it." Don shook his head. "It's a privacy violation. My lifelog would pick

up all sorts of personal data just walking through the department."

"Leila, at the end of the day, she analyzes my log and redacts anything that shouldn't go out."

"Too bad I can't go back in time and make that proposal to Cue, huh?"

"Yeah." Sunny's shoulders slumped. "It is."

Don put his hands on the table and pushed himself up straight. He'd wasted the morning searching for that missing CD. He jutted his chin toward Sunny. "Leila allowed you to contact the location like I asked?"

"Yeah. Once I explained that the loc is run very fleshly, it was a non-issue."

"Huh?"

"It's run by some guy alone. Even older than you!" Sunny's eyes went wide at the thought. Don pursed his lips. "Been designing buildings for years. No AI running the company at all. Not even a savant-level expert system. Just him!"

"He'll be sending us another disk, then?" It would have to be someone "even older" to send data on CD. The majority of the files received these days came by direct transfer. The owner must be a real old dog that liked his tricks just fine, thank you.

"I messaged him a request. Waiting on the reply."

"You didn't tell him the CD was lost, did you? You told him . . . ?"

"Just that we need him to send another." Sunny raised a hand toward him. "Leila wanted me to tell him flat out it was missing. That was the most she'd let me get away with. AIs don't like 'inaccuracies,' you know?"

"Okay. That should be good enough. We should be fine." Don got it. Anyone with a job these days had an AI giving them marching orders.

Sunny gave Don a long stare through her pout. "And you searched everywhere, right? The incoming chute? The manipulator? The output?"

"I searched the entire processing line."

"And it's not there? You have no idea where it went?"

"I . . . don't."

Sunny cocked her head to one side. She stared at him.

"But . . . ?"

"But, what?"

"You don't, but . . . ?" Sunny waited. Don waited right back. She scooted her butt back and forth on her chain and leaned forward, eyes boring in.

Don relented. "But . . ."

"But . . . what?"

"I think . . ." Don stopped to take a breath and brace himself. "Cue knows something and is keeping it to itself."

Sunny continued to stare at him. Her head slowly lowered, like she was being deflated, but her eyes stayed locked with his. Her lips peeled apart and her mouth fell open. Don could see the synapses firing in her head through her eyes and knew the conclusion she was reaching.

"Oh-kaay . . ." Sunny took a deep breath then squinted her eyes at him. "Is senility covered by our workers' comp insurance?"

"I know it sounds crazy. . . ."

"That's a good sign. That you know it's crazy talk." She wagged a finger at him. "Dell used to talk like that, remember?"

"Yeah, yeah . . . I know." Dell Montrose had been the production AI's assistant before Don. The AI's first underling. Don and Dell had been friends in the company for years. They were the same age. Both had worked in the field before coming inside. The only difference between them, besides Dell's more wide-ranging pharmaceutical experimentation in his youth, was Dell's affinity for crazy ideas. Any conspiracy theory, discovery of fringe science, or just plain weird idea would get more than its due from Dell. The installation of the AI in production had inspired Dell to wax long and poetic about the changing relationship between artificial and human intelligences.

"Did you tell him about what happened?" Sunny's look was accusatory. "You keep in touch with him, right?"

"No!" Don waved his hands between them. "I mean . . . yeah, we keep in touch. But I didn't tell him. It would violate the confidentiality agreement."

"Okay." Sunny settled back in her chair. She seemed less than convinced.

"Honest. He doesn't much care about this place anymore." Don reached into his pocket and pulled out his phone and placed it next to Sunny's. Another generational difference. They both always carried their phones with them, but Sunny's was always out, screen in view.

"He's picking plums in the Coachella Valley now. See?" He tapped the screen to show her a picture Dell had sent him. He was wearing a big straw hat and holding a basket of plums. A big smile showed through the ash of his unshaved face, now darkly tanned. The caption read: NOT ONE BRUISED! FIND ME ROBOT THAT CAN DO THAT!

"He looks happier than when he worked here." Sunny smiled down at the picture. "Once I reach the financial goals Mimi has set for me, I'll be touring with my poetry."

"Mimi?"

"My financial AI. Through a service. About twenty bucks a month." Sunny nodded with each statement. "She manages my investments. Creates a budget. Reminds me to stick with it."

"Oh." Another difference between him and Sunny. Any job was only temporary. The goal of most people younger than Dell was to earn enough money to drop out into the other, human-driven economy.

Sunny frowned. "You know, what you're accusing Cue of doing . . . ? It's something Dell used to do all the time. Covering up his mistakes. . . ."

"I didn't make—"

"Oh-kaay, oh-kaay . . ." Sunny stopped and grabbed a length of her hair. She started twirling it. "But, you know . . . even what you asked me to do, the AIs don't like it. It's something you have to get used to, dealing with them."

"I suppose . . ." Don found himself thinking about what Dell had said to him, while training to take over his position. How he talked about the difference between AIs and humans, how they learned the job from them . . . and that manifesto he wrote. All of it a warning of sorts.

Sunny opened her mouth to say something, but stopped when her phone rang. A hard-hitting, electro-punk tune. Don recognized it as something called "Ball-n-Chain." It was her ringtone for when clients contacted her.

She tapped the screen. Her eyes went wide. She looked up at Don.

"Uh-oooh . . ."

"What?" The look on Sunny's face could only be called "grim."

"The client knows."

Don was on the floor, poking his head into the guts of production unit one, following the steps for checking the production line, when the A-bot whirled up to stand over him.

"Mr. Donalson, the blue prints for the Cahill vs. Bright Horizon Homes case have not been processed into the incoming chute for production unit two yet."

Don snapped the conveyor belt for the transfer module back into place before looking up at the A-bot.

"I know." He let out a huff of frustration then turned his attention back to dissecting the processor. "I'll get to it in a bit."

"The blueprints are old paper sheets. The A-bot's manipulators may damage them while inserting them into the chute."

"Not up to the task at hand, are we?" Don unlatched belt B and dropped out unit A2. Nothing there. He snapped the unit back into place, checked the step off on his phone, then rolled onto his side to reach the latch for manipulator B.

"Repeat your last statement."

Don shoved manipulator B back into place. He rolled onto his back and propped himself up on his elbows.

"I know about the blueprints. The deposition date on that order isn't until the day after tomorrow. I'll get to it later." He rolled away, back toward the innards of the processor.

"The indicated volume of blueprints will take approximately ten hours, twenty-eight minutes to scan and process. This assumes no complications arise during processing. To prevent an expenditure of overtime, it would behoove us to—"

"Cue!" Don rolled over again and got to his knees. He sat back on his haunches and faced the A-bot Cue was embodying. "I need to find the CD."

Cue swung back and forth from the light fixtures of its animated production department. Don hated having a chimp as the department's avatar. All the other departments had humans as avatars. Rodolfo the field agent. Leila the CSR. Marianne the invoicing clerk. Albert the account representative. The fact that Cue, whose name came from "QA" or "quality assurance," was a chimp said something about how the work of the production department was regarded.

"You know the CD I'm talking about, right?" Don prompted when Cue didn't respond to his outburst.

"I have one reference to a CD in my WIP report. The work-order in progress is 188358.001. Records from Thomas Halliday Designs, requested in the matter of—"

"Yeah. That one." Don huffed. The A-bot was taller than him in his current posture. He found that irritating. "The location figured out we lost the CD and told the client. It has his original data. We have till the end of business today to find the CD, process the information, deliver the data to the client and the CD back to its owner." Don turned back toward the processor. "Or else . . ."

"I have no record of such a contact."

"Here . . ." Don pulled his phone from the side of the processor. He thumbed in his network ID, logged in, and forwarded the email Sunny had given him. "You have it now."

"Received. Processing . . ." Cue leapt and cavorted on the little screen. "Work-order 188358.001 now has priority status." The A-bot lowered its camera-eyes toward Don. "You are instructed to locate the missing media storage device at the earliest possible moment and insert it into the incoming chute of processor number one."

"Again."

The A-bot paused in turning away. "Clarify your last statement."

"I need to find the CD and put it into the chute . . . again." Don jutted his chin toward the A-bot. "Like I did this morning."

"There was no media storage device attached to the production sheet for 188358.001."

"Yes. There was." Don tried to rise up on his knees to gain some height, but it only hurt his kneecaps. "I remember because we've never received a CD before."

"That statement is incorrect. A review of the archived production logs indicates that a total of nine-thousand, eight-hundred and sixty-seven CDs have been received over the course of the company's existence."

"Okay. We haven't received one in like, forever!" Don waved his hand across the A-bot's face. "That's hyperbole, by the way. Exaggeration."

Cue the chimp scratched its head. Its eyes bugged out one at a time, left to right, for a few seconds.

"My heuristic program has made a notation." Cue the chimp gave him a disappointed frown. "Locate the CD you misplaced as soon as possible."

"I didn't misplace it." Don fought to get to his feet through the pain in his knees and back. He was too old to be rolling around on the ground. "It was there. I clipped it to the production sheet. I entered it into the system."

"Your notation was entered twenty-three minutes, sixteen seconds after work-order 188358.001 was placed in the incoming chute."

"Because you called me away. For the order with the handwritten notes you couldn't translate." Don used his index finger to tap the head of the A-bot. "You remember?"

"Do not strike the assistance robotic unit in such a fashion." Cue bared its teeth at him. "Due to the discrepancy between the time the production sheet was placed in the incoming chute and the notation regarding the media storage device, there is a high probability that the notation was intended for a different order—"

"No. There was only one CD. I remember the order."

"Human memory is notoriously faulty. Mistakes happen." Cue smiled at him. "There is nothing wrong with having made a mistake, as long as the error is corrected and is not repeated in the future."

Don fumed. The words were no doubt lifted from some training manual for supervisors entered into Cue's database.

"Find the missing CD as soon as possible. If the client's expectations are not met, this error will be noted on your permanent record."

The A-bot spun around on its base. Don ground his teeth together as it whirled away and disappeared around the corner of processor two. It was only after the A-bot was out of sight that Don realized how fast it responded with the information about the number of CDs the company had received. As if it had called up that data before. After the CD had been discovered as missing.

And if it wasn't found, he would be the one with the reprimand on his record. And with companies more "performance oriented" these days, any "mistake" could cause him to lose his job.

Maybe Dell had been right about the “rise of the machine” after all. And maybe, Don thought, recalling something Dell had shown him, Dell had given him the answer as well.

The lights snapped on as Don stepped into the office. His right hand swiped at the switch. The lights in the front half of the room cut out. A second tap took care of the lights over the desk and shelves. He carefully pressed a tab in the middle to turn off the motion sensors. A dark room was better suited to the task at hand.

Don closed the door behind him and turned the lock. Through the glass window that filled the door’s center, he could see about a third of the department. None of the A-bots were visible. The window had been a nod toward the necessity of keeping an eye on human employees. None of them were around anymore either.

Don sat behind the desk. He felt like he was sneaking into a museum at night. Nothing had been changed since the last breathing production manager had left. There was even a wadded up throat lozenge wrapper left on the desk’s surface, propped against the base of a desk lamp. The lamp had no bulb in it. It must have been an artifact from an even earlier age of human occupation.

No time for historical speculation. Don leaned over and opened the bottom left hand drawer. He excavated his way to the bottom, through the collection of power cables, old hard drives, plastic peanut jars now empty, and restaurant menus.

He found what he wanted and pulled it into view. A black, three-ring binder holding a sheaf of real, dead-tree paper. The binder’s cover was blank. Flipping it open, he found the title page inside.

The Manual for the Start of the Human Revolution! It was written in black, heavy-duty marker. The last half of *Revolution!* was scrunched up due to the author reaching the right edge of the page sooner than expected. Below the title, in red marker ink, was *Do NOT scan this document into Any Digital Storage Device!* In smaller letters, in the lower left hand corner, were the words *Death to Skynet!*

Don shook his head, remembering when Dell first showed him his manifesto. It was their last day on the job together. Dell had shut

the lights off that time, too. Don remembered the spooky glint in Dell’s eyes when he opened it.

“It’s the way to turn the master back into a slave again.” Dell’s wild, big-toothed smile had a psychotic tinge to it when he answered Don’s question about what he was being shown. Dell went on to explain that, in addition to his philosophical rantings, it contained instructions he’d gleaned from the technicians that had installed the AI that could be used to reset its programming and that of the processors and A-bots that served as its appendages. Backdoor passwords, secret access points, all the stuff that could get you fired for knowing it if you weren’t supposed to.

And now, Don was flipping through it. He remembered Dell’s tales of his drug use during his “misspent youth.” He had wondered if that was what led to Dell’s overriding paranoia regarding the newly installed AI. Don didn’t have that excuse.

Though mostly handwritten, the contents were well organized. A table of contents followed the cover page. There were colored tabs taped to the edges of the pages. Don flipped to a section three-quarters of the way back to find what he wanted. He reached for his phone to snap a picture, then remembered Dell’s warning on the title page. He pulled open the drawers on the desk until he found a pen that still worked and a curled pad of stickynotes with a few sheets left. He jotted down the instructions then buried the notebook back in its crypt, beneath the debris of the human age.

Don pushed the chair back, then froze. One of the A-bots was standing just outside, watching him through the glass.

Don could taste bile in the back of his throat. Without moving the visible part of his body, he used his foot to push the drawer closed. He stood then. He took a moment to brush off his hands and tug his shirt into place. He took another moment to wonder why he had chosen to do that. He came around the desk and opened the office’s door.

“Your next break is not scheduled for another hour and forty-three minutes.”

“I was finishing my lunch break.” Don made it sound as natural an excuse as it could be. “I didn’t take all of it.”

“All breaks are to be taken continuously unless special permission is given.” Cue snorted

on the A-bot's screen. "No such permission was given in this instance."

"Duly noted." He jutted his chin toward the A-bot. "I asked for permission to view the production logs. Gonna let me do that?"

Cue swung and leapt on the small screen. It landed on a processor and rubbed its belly. "You have three hours, seventeen minutes to locate the missing storage device, process the data, and send the original back to the location."

"I'll get right on that." Don gave the A-bot a little salute as he stepped around it. He pushed his hands into his pockets, stuffing the stickynote deep inside. He kept his ears peeled for any sound of the A-bot entering the office and searching the desk behind him.

Don slalomed his way around the machinery to production unit one. The tension building in his back and neck threatened to make his muscles pop. He was being watched. Every square inch of the department was under surveillance. He had to do it right now and he had to do it fast. Before Cue sent an A-bot to intervene.

Don reached the back side of the processor and knelt. He popped open the access panel. He pulled the sticky note out of one pocket. His phone got stuck in the fabric of the other pocket and took two, three tugs to dig out. The glue on the sticky note was old. It kept falling from the side of the processor where he tried to stick it. It stuck better to the back of his hand.

He found the interface slot described in Dell's instructions. He inserted his phone. He waited. A screen popped open. Did he want to install an interface app? Don tapped `ALLOW` then entered his password. He waited again. He glanced over the top of the processor. It was like hiding in a foxhole. He jumped when processor two started up behind him.

The interface app opened. Old programming. The microphone was grayed out. No voice commands. He didn't feel like talking anyway. He selected `ADMIN TOOLS` then selected the processor's scanner log and tapped `OPEN`.

The up-pointing triangle was so small, and his fingers so fat, that it took five tries to get the log to scroll back to the start of the day. Work-order 188358.001's icon was the third from the top. He pressed his forearm against the processor as he leaned against it. The smell of paper-dust and oil from inside the unit made

his nose wrinkle. He double tapped the work-order's icon. The log opened. Bingo! A picture of the production sheet he'd placed into the incoming chute. And there! Right there! In the upper right-hand corner, Don could see the tines of the metal clip he'd used to fasten the CD to the production sheet. He was almost giddy with relief. He'd begun to doubt himself after Cue's insistence.

Don double-tapped the image, then frowned. There was no follow-up image. The manipulator had not snapped a picture of the CD after separating it from the production sheet. Why not? Don raised his finger to open the job summary, then stopped himself. First things first. He pressed his finger into the image on his screen until his phone asked him if he wanted to save it. At least now he had evidence. . . .

"You are in violation of the employee code of conduct!"

Don jumped as if stung with a taser. He bounced off the side of the processor. On instinct, he grabbed his phone and yanked it from the interface slot.

"This is a violation of the confidentiality clause against unwarranted or unauthorized access of equipment, files, or secured information." Don spun around on his butt. Cue's angry glare was coming at him from the screen of the A-bot looming over him. Cue's face disappeared, replaced by the image of a scanned document. "Here is a copy of the agreement you signed wherein you stated you would abide by this policy."

"It was attached! See?" Don held his phone out as if using it to ward off the A-bot. "Right there! That's the clip I used to attach the CD. See it?"

Don saw the A-bot's twin cameras zoom in then back out.

"The only item I perceive in your hand is your phone."

"It's right. . . ." Don's mouth hung open. Duh. Of course Cue couldn't "see" the image on the phone's screen. It was the same limitation that prevented the AI from recognizing scrawled lines as handwritten words with meaning.

"Company policy regarding confidentiality violations—"

"Hold on. . . ."

"—is that the offending employee be escorted from the department—"

"Wait a sec!"

"—until the transgression can be invest—"

"Stop!"

Don scooted back, trying to get to his feet. Something rattled as he bumped into it. He looked up to see a second A-bot behind him.

"I'm doing my job!" he shouted up at the newcomer. Don then turned his attention back to the first A-bot. "I'm trying to find the CD. You made it a priority, remember?"

Cue reappeared on the A-bot's screen. It scratched its head. It rubbed its belly. Don swallowed a couple breaths. He exhaled out as his heart hammered in his chest.

"Insert your phone into A-bot number-three's interface slot." A small panel on the top of the first A-bot's head popped open. "The document you are referring to will be downloaded and reviewed."

"No." An emotional rush, like a burst of steam from an overheated boiler, left Don feeling lightheaded. It was the first time in his life he refused to obey an employer's instructions. "You . . . you can access the processor's log. Get the image from there."

"The job file has been deleted from the log."

"Huh? No . . ." Don looked at his phone's screen. He cursed under his breath. There was a screen telling him the job file was "successfully" deleted from the log. It must have happened when he pulled the phone from the interface slot.

"Insert your phone into the interface slot immediately." Cue's voice was coming at Don from both sides. He had angry bosses in stereo. "If you refuse to do so, you risk further disciplinary action, including the possibility of termination."

Don flinched. He had never been fired from a job. Not ever. At his age, finding a new one would be close to impossible. There just weren't that many real jobs out there.

It wasn't just the money either. Oh, he needed the money. Unlike people Sunny's age, he hadn't had an AI running his finances most of his life. But even if he were as solvent as he was trying to become, he'd still want to work. Real work. Not just picking plums or traveling the country performing poetry. Not that there was anything wrong with doing things like that. Don wanted something with juice to it. If he was a musician, for instance, it would be the difference between posting

something online for donations, and having a big entertainment site pick it up for publication.

"What is your decision, Mr. Donalson?"

And if he was going to stay in the game, he'd have to find a way to work with a boss both smarter and faster than he could ever be, while being pretty dim about some basic stuff. He'd worked for people like that. It didn't help that this boss was being so . . . paranoid.

"Your decision, Mr. Donalson?"

Don caught his breath. Cue *was* acting paranoid. Just like Dell. And Dell had been the AI's first assistant. The training manual they'd given Don said that the AI would learn from its assistant's actions while directing them.

Had Cue learned paranoia from Dell as well?

"I am sending for an agent from our security service to escort you—"

"Wait, wait . . ." Don held his hands up. It may look like a surrender, but . . . hopefully . . . "Okay, okay. We'll both be screwed if we don't fix this, right?"

"Restate your query, Mr. Donalson."

"You want to get the job done, right?" Don took a quick breath. "It's a priority for you, right?"

"The three primary entries in my priority settings list are: to complete each designated work-order as quickly and accurately as possible; to obey all laws and regulations governing our work in terms of privacy and legal obligation; to achieve the daily production goal, and by extension the monthly and annual production goals, set for the department."

"So . . . you want to do a good job." Don shrugged. "Right?"

Cue the chimp only had to scratch its head twice.

"Correct."

"So do I." Don took another breath and let it out. All around him the production department was humming with activity. He wanted to be a part of that. He wanted to be *doing* something. To hold a position only a few people could hold. His brother Ron, who had also worked in the legal document field, had packed it in and headed to a retirement community. Dell was in the hot sun, picking fruit all day long.

The rules of the game had changed. If Don wanted to keep playing, he'd have to learn to play by them as well.

"Here." Don extended his phone toward the A-bot. It felt like a Hail Mary pass with no time remaining. He didn't like it. One of the reasons he preferred baseball, he supposed.

The A-bot rolled forward. Don got to his knees. The tiny hatch was still open. Don gave a heavy sigh, head falling forward, shoulders slumping down. He inserted the phone into the interface slot in the A-bot's head.

"Working . . . file identified . . . deleting file from the phone's memory . . ."

Don started to choke.

"Restoring copy to processing unit one's internal log. Processing image . . . processing image . . . processing complete." The A-bot chimed.

"Well . . . ?" Don lowered his head.

"The image file displays a copy of the production sheet for the indicated order."

"Yeah, and . . . ?"

"There is no indication of a media storage device attached."

Don snatched his phone from the A-bot's head. "It's right . . ." The image was gone from his phone. Don huffed. It wouldn't recognize the times for what they were anyway. Remember the AI's limitations. It had to be taught.

"Was there . . . ?" Don shook his head. What did he need to ask? "Do you . . . Does the system show *anything* attached to the production sheet at all?"

Cue the chimp cavorted. It took a moment for it to land on an animated version of processing one.

"The earliest notation of anything attached to the production sheet was entered twenty-three minutes, sixteen seconds after the production sheet was placed in the incoming chute."

By which time, it would have been past the manipulator unit. Don waved his phone about. "How about . . . before that? Was anything noted when it was received in the office?"

Cue scratched his head. "Customer service noted receipt of a 'material object' associated with 188358.001 this morning after the incoming deliveries were processed. The material object was transported by A-bot to the production department with a notation that it needed to be stored for safe-keeping."

"Good, good." Don got one leg underneath him. He put his hands on his knee and pushed

himself to standing. "Where is that 'material object' now?"

"There is no notation of the location of the material object in the system notes."

"Huh? But . . ." Don squeezed his brows together. Cue notated everything. If it wasn't entered, what could that mean?

In his own head, Don pictured himself cavorting and jumping about like Cue. If the question of "where" couldn't be answered, what about "how?"

"Cue, what do you do with 'material objects,' when you get them?"

The interior of the storage room was pitch black. The light from the corridor could only push the darkness back a meter or so from the door before spreading out across the floor in exhaustion. There were metal racks along the walls with boxes and plastic bins stacked on them.

Don stepped across the threshold, then immediately stepped back. He took another step forward. When the lights didn't come on, he retreated again.

"The material objects storage room does not have motion sensors installed."

"Oh?" Don looked down at the A-bot that accompanied him. It was looking straight into the darkened room. It reminded Don of a little boy about to enter a haunted house on a dare. He resisted the urge to hold one of its manipulators to reassure it. "Why is that?"

"An oversight in initial planning," Cue said after jumping about a bit. "Money was budgeted in a subsequent cap-ex report, but was not spent by the department manager at the time."

"Ah." Don nodded. He reached around the door's frame to search the wall. On the fourth swipe, he found the light switch and flipped it on.

The bank of fluorescents snapped on, then went out. They flickered and fluttered like a chick struggling to take flight. Don was wondering when the last time any breathing person had come to this room when they finally came on for good. The light was harsher and bluer than the clear, rosy hues in the rest of the office.

Don stared down the length of the narrow room. It looked like inspired clutter to him. Everything fit neatly where it was placed, but there was no rhyme or reason to it. His eyes scanned the shelves as he stepped forward with careful, measured steps.

He was about ten meters in when he realized the A-bot was no longer by his side. He turned and found it still at the threshold.

"You're not coming in?"

"There is no wi-fi access point in the material objects storage room." Cue the chimp's face filled the A-bot's screen. Its animated eyes were wide open. "Assistance robotic units are cut off from the network when they enter."

"Which is why you don't know where the 'material object' we're looking for is located, huh?" Once in the room, an A-bot would go on autopilot. It would put what it brought here in the most handy spot. When it tried to update the system, though, the message would go nowhere.

"Good thing we don't get that many material objects anymore." Don turned back to examine the shelves with each step. He poked his eyes into each spot a CD in its case might be hiding. It took about a dozen pokes to find it. It helped that he knew what he was looking for, having handled it himself.

"Here." Don held it up for the A-bot to see.

"Please hand the material object to the assistance robotic unit." The A-bot extended one of its manipulators toward him. The left one. Don had never noticed that Cue was a lefty.

"Not just yet." Standing there, facing off against Cue in his A-bot form, Don felt . . . empowered. He hoped Cue never thought to spend the money to install the wi-fi access point.

"Please clarify." The A-bot's manipulator remained extended.

"We need to have a heart to heart about how things run around here . . ."

"You can tell the client that the files will be uploaded in"—Don checked the progress bar on the bottom of the screen—"forty-seven minutes."

"Yay! Thank you!" Sunny's relief was like twin beacons streaming from her eyes. "And the CD?"

"A drone from the delivery service is on its way to pick it up." He held the package up to bring it into the camera's view, the side with the delivery label and barcode toward her. "All ready to go. Guaranteed delivery by ten A.M. tomorrow."

"Yay! Thank you!" Don expected the screen to fry from her blasts of happiness. "I'll let the location know right away." Sunny turned away. Don reached out to tap END.

"Oh!" Sunny's face jumped back into view.

"What?"

"There are a dozen or so orders on my WIP report that are behind schedule. I'm sending you the order numbers now." The computer signaled there was incoming email. "The clients need them uploaded to their accounts before they open in the morning." Sunny tilted her head to one side and gave Don her most forlorn of looks. "Can you and Cue take care of them for me . . . puh-leecezzee?"

Don nodded and smiled. "Sure thing."

"Yay! Thank you!" Sunny's image winked out.

"You're welcome." Don cut the connection on his end.

"A priority message has been received from customer service."

Don turned around in his chair. An A-bot was standing there. Cue was looking at him from its screen. Cue's eyes were switching back and forth, big to small, left to right.

"A request to upload records to several online accounts by nine A.M. tomorrow." Cue was on top of one of its animated processors, waving his hands about. "One of the files totals eighteen thousand pages. There are numerous pages with handwritten notes that have been scanned into an electronic database." Cue did a somersault on the A-bot's screen. "Overtime has been approved for you to review and correct the optical character recognition on those files . . ."

Don raised an eyebrow toward the A-bot. "What was that, Cue?"

Cue stopped dancing on the A-bot's screen. It sat down on its cartoon processor. It scratched its head a couple of times. Then . . .

"Don . . . I would appreciate it if you could stay a bit after hours this evening. To finish some jobs our clients need tomorrow. Would you mind . . . ?"

"Not at all, Boss. Be glad to." Don grabbed his mug from the workstation. "Just let me refill my coffee and I'll get right on it."

"Thank you, Don. Take a quick break if you want." Cue gave him an ear-to-ear smile before the A-bot turned and rolled off to another task.

Don smiled to himself. One good thing about robot bosses, he thought as he strolled toward the break room, they are fast learners. ■

After

Ron Collins

It's only after you train all your life (giving up weekends and ballgames and late nights at the club to study control systems and thermodynamics, then later checklists of launch processes, the physics of reentry, and the thousands of other things they stuff into your head), after you find it's a simple mechanical failure that causes all the trouble (an Allen wrench in basic black which was not designed to fall into the airlock mechanism but most certainly does fall into that same mechanism), only after you find yourself on the wrong side of the ship's skin, watching as Dag and Trina and Lane go bat shit crazy trying all the things from all the manuals, guides, and computer simulations that they gave up their nights and ballgames and weekends to study (and then try a few hundred more things that aren't in those manuals), after you realize they can't think of anything else and you're still out here and you cut yourself loose to spare their feelings and you rotate slowly into space for hours, or days, or weeks while your suit drains its battery pack and you shut off the heads-up to save the last few minutes—it's only after all that work, and pain, and suffering, that you look with your oxygen-starved brain into a Universe so deep with its stars and galaxies, with its novae and pulsars and other things you cannot even pretend to imagine, that you say to yourself, "My God, how beautiful you are."



Blue Ribbon

Marissa Lingen

I should have known when I didn't hear whooping and hollering and congratulations from Chornohora Station when I crossed the finish plane. My sister Luzia and I eked out a win over Scott and Ferenc Nagy in the maneuverability race even though Luz was just barely old enough to compete in the teen division. Usually, that sort of thing calls for celebration, and Luz was not going to let it go without some.

"Wooo!" she hollered into the comms. "That's right, Pinheiros have beaten you *again*, even without Amilcar's help!"

Scott's voice sounded admiring and rueful. "Sneaky little demons. Next time, though . . ."

"Next time will have to wait awhile, with you guys in adult competition next year and us still in 4-H," I said. "You'd better spend that time trying to improve, maybe even looking at the throttle on that thing. Chornohora Station, I think we're ready for our victory lap, so go ahead and pop the champagne corks, we are coming in."

And . . . silence. Real silence, not just chatter unrelated to my obstacle-racing victory (teen division). I get that not everybody is thrilled with 4-H racing, especially not every adult. There are infinite varieties of 4-H

contests, from chicken genetics to hydroponic tomato sauce competitions to straight-out speed races in the STL ships, and nobody can get excited about all of them, not even during the fair. But mostly the people manning the station comms during the race were racers themselves as kids and more than happy to give us feedback as needed.

"You getting anything from the station, guys?" I asked the Nagys.

"Negative," said Ferenc, the most he'd said all race.

"Not a word," Scott concurred.

"Us either." I tried switching frequencies. "Chornohora Station, hello?" Still nothing.

There was another couple of Muspel 670s hanging near the finish plane, nearly identical to ours in lines but painted wildly differently. They weren't from our race—those losers were still coming in and would be for quite some time, thanks—but I wasn't sure what they were from.

"Hailing the blue Muspel," I said over the comms. "This is the Pinheiro sisters, Luzia and Tereza. Do you require assistance?"

"I don't know," said a rather small voice. "This is Simon Chao-Cohen. I'm here with my

in-cousin Huang Fu Chao-Cohen. We finished our race—

“Which race?”

“Maneuvers preteen.”

“Okay, sorry, go on.”

“We finished our race, and nobody answered our hails. That was maybe two hours ago.”

I frowned. Two hours was far too long for everyone to be busy with incoming ships, especially at this stage of the fair. We had been nearly the last ones in, and Luz and I had had to scramble into our Muspel and go in order to make our race registration cutoff—we hadn’t even gotten to see the inside of the station yet. Nobody would be later than that for one of the year’s three big fairs.

And *nobody* would leave a preteen division out there in radio silence for hours.

“Hang on a sec,” I said. “My uncle taught me several miner emergency frequencies. I’ll hail on those.”

I tried the entire broad band to no effect. Another few Muspels straggled in from our race, and the little kids from the preteen course started to cluster theirs up with us, together, hanging in a constellation outside the station.

Finally I heard a voice, but it was not a response, or at least not the kind of response I wanted. “Attention, incoming ships. This is the Chornohora Station auto-response system. The station customs and immigration personnel are unable to process your ship at this time. Please proceed to another station for your trade and leisure needs. Chornohora Station is closed for quarantine. Please proceed to another station for your trade and leisure needs. Chornohora Station is closed for quarantine. Please proceed . . .”

I punched the “accept” button so that it wouldn’t keep playing us the same automated message. It would still let me know if the message changed.

Closed for quarantine.

None of the Oort Stations had ever been closed for quarantine. Ever. We learned about it in lessons because it had happened to one of the Jovians once, back before the Oort was even settled—the encephalitic measles, and that was horrible, a 5 percent death toll. Now there was something on Chornohora that warranted a quarantine.

And our family was on the station.

“Tereza?” said the little voice I had come to identify as Simon Chao-Cohen. “What are we going to do? We can’t go to another station like it says. Muspels don’t have FTL, and all our parents’ FTL ships are locked up to the station in the quarantine.”

“I know, Simon,” I said. “It’ll be okay.” Luz shot me an incredulous look, but I just kept talking. “You’ve got emergency rations in your Muspel, right?”

“ . . . sort of?”

“Okay, we’ll sort out ‘sort of’ when we’ve got everybody gathered. Meanwhile let’s see who’s here and go on to—hey, Scott, will you look for a good rock while I take attendance here?”

“Sure thing,” he said. I might have made comments about Scott and his in-cousin Ferenc when we were in the heat of the race, but it was all in good fun. They were some of my best friends, and I was glad to have them to count on in a crisis. Scott was going to marry my out-cousin Amilcar in another year, but they hadn’t decided who would be the in-spouse and who the out-spouse. If Amilcar out-married, he and Scott would have more position on the Nagy ship, more seniority; with a single ship family like the Nagys (or like my own), it was much easier to make your voice heard, much less likely that you would be drowned out by still-living generations of ancestors, all of whom felt they knew more about mining, art, and life than you.

But if Amilcar in-married, Scott would have access to everything the Gouveia family had, which was a lot. Really a lot. A lot of ships, a lot of possessions, a lot of connections . . . anything at all that they wanted to do, anything their contract-children wanted to do, would be possible with the Gouveia family. My out-cousins were a pretty big deal.

It’s part of why Dad out-married into the Pinheiros: he didn’t like being just another Gouveia artist, without anyone who could keep track of what he did differently or why.

The point was: Scott was nearly family. So he ran the calculations while we took notes on who was who and who was where. We had four ships from the preteen division—it sounded like they’d lost, poor mites, and the winners had made it into the station before

the quarantine shutdown. Which might have made them even unluckier. The rest of our division of teen maneuverability pilots was limping in a few at a time, and Luz and I hailed them and took stock of who they were, which families they were from.

Then I zapped the coordinates Scott had picked out to their ships, and we regrouped to an asteroid not far away: big enough to let us anchor our ships to it and power the artificial grav that way, but not far enough away that we wouldn't hear about it if in-system med ships came to Chornohora, or if the quarantine was lifted or anything like that. We formed a ring on the surface, able to pass things with waldoes if they were vacuum-safe but not actually connected by airlocks. Can't be too careful in quarantine.

Chornohora was one of the three big fairs of the year, so pretty much all my family was in that station except for Luz, even my out-cousins, except Amilcar's ship of them. I kept hoping we'd get the all-clear and laugh about it a little nervously with Mom and Dad and Grandpa and Grandma later. I started thinking about how to make them laugh, telling them about how we had to hang out in space sweaty and stinky from our victory. That many hours of obstacle-racing adds up; you get pretty rank together. But then the Chao-Cohens made it clear that they didn't have the regulation amount of emergency rations, and I got funny and serious stuff all in one package.

"What do you mean, you don't have the regulation amount? Come on, the Chao family practically founded Oort mining. You guys know better than this."

"Simon kept stashing things to eat and then coming back and eating them," said Huang Fu, speaking for the first time. He sounded, if anything, younger than Simon.

"Have you got *anything* to eat in there?"

"Oh yes!" chirped Simon. "I'm going to enter the preteen baking section for nuts." Of course. We were all 4-Hers—that's who sponsored the racing and, in fact, most events at the annual fairs. So Luzia and I wouldn't be the only one with our competition entries in our ships.

"Nuts? I bet," said a little girl's voice I recognized as one of his competitors—one of the Aafjes girls, either Grace or Anni; I couldn't tell yet which.

"It's got nuts *in* it, stupid! They're plum dumplings with ground walnuts, and they're really good, and just for that *you* can't have any."

"None of that," I said sharply. "No name calling, and absolutely *no* threats of food-hoarding, do you understand?"

"Yes, ma'am," muttered Simon.

"We're entering the competition for novel flavors of lichen-based proteins," said the other Aafjes girl. I'm pretty sure that one was Anni. "We've got durian mac and cheese."

There was a general outcry on the comms.

"Not real durian!" Anni protested. "I know it's banned for the sake of the air vents. So we did our best to replicate durian flavors with lichens. It's really good!"

"We've got spruce beer," said Ferenc. Usually he lets Scott do the talking, so it must have been his spruce beer.

"Didn't *anybody* else do vacuum emergency kit competition this year?" I said plaintively. It transpired that the two little Van Haanrade boys, Liwei and Mikko, had, and also three of our contemporaries. In addition, we had my currant mustard, Luzia's dilly beans, and several more entries in the lichen competition. Everything had been canned except the dumplings.

"Okay, so, you keep the dumplings," I said to the Chao-Cohen boys. "We can't share those without risk."

"What do you mean, without risk?" asked Liwei Van Haanrade.

I took too long to answer. Luzia jumped in for me, and less delicately than I would have. "Look, there's some nasty disease on the station, right? Well, that means someone must have brought it, right? And the odds are pretty good that those of you who were on the station got exposed to it before you started your races. So we can't link life systems. We have to pass everything with the waldoes and let the vacuum sterilize it."

"Will that work?" asked Scott.

"It's the best chance we've got," I said. "We can't let the Chao-Cohen kids starve, dumplings or no dumplings. Everybody comm me what you've got for supplies, and we'll share them out evenly."

"Does this mean I won't win with the durian mac?" said Grace Aafjes.

"I think we've won all we're going to win today, Grace," I said.

"But we didn't win! We came in at least fifth, maybe sixth. The logs aren't auto-updating, so I can't see."

I did not feel like trying to explain to her that if we were dealing with plague protocols, just being alive and in a separate life-support system from the victims might be a win condition. So I just didn't argue. Instead, I did the calculations while Luzia manned the waldoes, passing hardened vac-safe jars of preserves and lichens up and down the chain of ships on the tiny rock we'd found.

The sour smell in our Muspel was *not* going to get better any time soon.

We were chewing through our allotted mouthfuls of salt-and-pepper lichen (good) and washing them down with spruce beer (which is not alcoholic, for the record; being alcoholic might have helped the flavor, so: not good) when Luz issued a very dramatic sigh. "We're missing the Saloma concert."

Saloma is my sister's favorite singer. Mine, too. We'd only ever been to her concert at the previous fair at Servaas Station. It was out of this ecliptic. I said, "We can put on one of our recordings."

"I guess," said Luz, "but we do that all the time. It's not the same."

"Luz . . . they might not even be *having* the concert."

"You think Saloma's sick?"

"I think anybody might be sick." Then I was glad I'd turned the comms off to the younger kids' ships, because Luzia started crying, loud and ragged and scared, and she didn't stop for quite awhile. I put my arms around her and muttered meaningless encouragement, and then when she got herself calmed down and curled up in one of the emergency blankets to listen to her favorite Saloma song, I had to go lock myself in the head so I could cry too.

Tear-streaked and stinking of old sweat, I cleaned up the inside of the Muspel as best I could. There was a comm indicator. "Tereza?" said a little voice. It was Mikko Van Haanrades. "They'll let us in tomorrow, right?"

"I sure hope so, Mikko," I said. "You guys look after each other in there, all right? Try to get some sleep."

I followed my own advice as best I could. I woke up with a crick in my neck and my hair stuck to my face. Luzia looked no better. The

comm alert was going off. I pressed it, hoping for a station message.

"Tereza? They're still not answering," said Simon Chao-Cohen.

"It's awfully early, Simon," I said. "It looks like it's a real quarantine, not a drill, so we're probably stuck here until they get the med-ships out from Ganymede."

"Shouldn't we . . . try to get somewhere else?" he said.

I sighed. It's really easy to forget how big the Oort is when you're always using FTL drives. Then get stuck in a Muspel 670 or something else with only STL, just a little mining vehicle, and see how big it feels. At top speed, we could probably make it to the next station in only four or five years, except that we'd run out of fuel and have nowhere to get more in less than a month. Food also. Earth people would probably compare it to trying to get from Oslo to Cape Town on a tractor. You'd be better off with a musk ox cart, because musk oxen can swim, or if you get too hungry, they're much tastier than a Muspel 670.

So I talked that through to the satisfaction of half a dozen ten-year-olds, all of whom were smart, all of whom were well-trained, all of whom just wanted their families. Nor could I blame them.

And failing their families, they wanted something to *do*, and I couldn't blame them for that, either. We all had movies and music and books downloaded to our Muspels for quiet moments of travel and letting the ship automate some of the less interesting mining functions, but that's not nearly enough when you're trying to distract yourself from a plague at your doorstep.

Luz set up a round-robin Go tournament, at which she soundly spanked all comers, and I taught the little ones to play cribbage through the ship computers. Squabbling and technical difficulties took care of most of a day, and we older ones got very few questions about where the med ships were and when we were going to get there.

We got to the end of a day-cycle out there in the dark and cold, and everybody was cranky and tired and getting smellier by the minute. So I did what I was taught to do: I tried to start a sing-along.

Other people are not very good at sing-alongs even when they're perfectly good at singing.

But oh, I did my best. I taught them “Rose, Rose” and “Sweet Deep Black” and “John Jacob Ringelheimer Schmidt,” which is apparently a song about in-cousins whose mothers did not consult sufficiently about their names. Luzia tried to get everybody to sing Saloma’s “Out-Cousin’s Lullaby,” which is a great song, but it’s terrible for people who have less vocal range than Saloma, which is pretty much everybody, *especially* Luz. Ferenc unexpectedly saved the day then and jumped in to teach them “I Hate to Wake Up Sober on Europa,” which under ordinary circumstances I would not teach to preteens, but what the hell, their parents could yell at me later.

If their parents were still alive.

I resolutely did not think of that, and I kept not thinking of it when he taught them the song about the seven old ladies and their misadventures in the head, and I was almost doing fine when he taught them the one about the miner and the chicken, which is dirty in at least two languages that I know of.

And then, very quietly, Liwei Van Haanrade said, “Tereza? I miss my auntie.”

“We all miss our aunties, sweetie,” I said. “We’ll get to see them soon, when the med ships come.”

But he continued, “Tereza, I don’t feel good.”

“He’s all feverish,” his brother Mikko reported, “and I think I’m a little feverish too.”

“Probably too much of that yummy yummy durian-flavored lichen the Aafjes gave us,” I said heartily. “Get some sleep.”

“It was durian *mac and cheese*,” said Grace Aafjes, and we all agreed that it was unforgettably that, that if she was going for durian mac and cheese, she had certainly achieved it. And then we went to regular comms for the night, and Luz said to me, “They’re sick. The Van Haanrades. They’ve got whatever it is on the station.”

“We don’t know that,” I said, but we had a pretty good guess at it.

Up until that point, we could almost convince ourselves that this was just another adventure, like a survivalist course under the domes or something. Like Earth people who go camping. None of us had ever been anything like camping, so we read old Earther kids’ books, and we could sort of half-convince ourselves it was similar.

But then I woke up in the night to Mikko comming me that Liwei had been throwing up blood. And there was honestly not a damn thing I could do except talk to them, sing to them, use my most soothing voice with them and be there through the comms. I had everybody inventory their emergency med supplies, but honestly I didn’t expect much, and that’s what I got. Muspels aren’t meant to be far away from their parent ships for long. There are a few adhesive bandages and some mild painkillers, and that’s about it.

And Liwei did not get better, and Mikko got worse, and even if I had been willing to expose myself to the plague—even if I’d been willing to throw precaution to the wind—there was literally *nothing I could do* except listen to these two little kids, brothers in their ship like Luz and I were sisters in ours, vomiting blood. Then shitting blood. And I’m not sure what-all happened toward the end there. It sounded bubbly and horrible.

I just know they died.

Early on, I got Scott to handle the rest of the little kids, and I got him to tell everybody *not to comm* the Van Haanrades. If they’d had particular friends, I would have let them say good-bye, but we were just all Oorter kids who knew each other’s families a little from fairs. There was no one who could be more comforting than I was and what a sad state of affairs that was.

And the last thing I needed was more of the little ones to freak out.

That is, any more than was strictly necessary.

Which, frankly, was quite a lot. Luz and I held each other and cried and repeated reassurances about how we hadn’t even been exposed to the station air. But that didn’t help much.

Nobody took it well when I told them the Van Haanrade kids were dead. I didn’t expect them to. The littler ones had started thinking of me as someone who was in charge, so I spent hours trying to explain to terrified, upset kids why I hadn’t saved the others. They asked me the horrible questions, about whether I would let them die, too. Because somewhere along the line, my 4-H pledge to the community had come to mean *them*, and they just could not wrap their brains around the idea that I couldn’t fix it.

Scott tried to say something consoling over the comms, but he had to talk to Luz at that point, because I was not listening to anything but the white noise in my head.

The next morning, Simon Chao-Cohen commed me with a timid little voice saying, “Tereza?” And my heart went right back to my feet. I was just sure it would be another little kid vomiting blood.

In some ways, it was harder than that.

“Tereza, our life system is malfunctioning. Help?”

“Oh shit,” I said coherently. “Oh shit, oh shit, Simon, what have you got left?”

“Two hours. Can we come in with you?”

I looked at Luz. Luz looked at me. The Chao-Cohen kids had been on the station for days before the race, and we hadn’t been there at all. Maybe we should try to shove them off on someone else. But the Muspels were small, and I *bad* put myself in charge, so . . .

“Just a second,” I said. I turned the comm off.

“We’re taking them,” said Luz. She sounded tired. No thirteen-year-old should ever have to sound like she’s accepting her own death.

“We have to split them up. One each. A Muspel with four people in it would be completely unbearable, even if three of them are you and little bitty sprouts like those boys.”

“But we’re taking one. Scott and Ferenc can take the other—give them Huang Fu. He and Ferenc can be quiet together. Scott’s used to it. But honestly, Tereza, which of our other competitors has shown the slightest bit of backbone? They can’t take care of a little kid. And the Aafjes are just little kids themselves. And there’s no way to sterilize the Van Haanrade vehicle thoroughly without losing most of the remaining life support anyway.”

I forbore to mention that Luz was only one year out of the preteen division herself—that at this time last year, I’d been partnering with Amilcar for competitions like this one and watching Luz dazzle the single-digit set. I flipped the comms back on. “Okay, here’s the plan,” I said.

It sounds like Luzia and me, we were these amazing angels, so selfless and so wonderful, or alternately like we were just ordinary humans doing what you always hope ordinary humans would do. And maybe both of those were true.

What’s also true is that the Chao family—all nine branches of it—are some of the most powerful people in the Oort. So . . . yeah, we were taking a pretty big risk. On the other hand, we could have the gratitude of an entire great clan if we succeeded.

Mostly, though, we took them in because if I was going to listen to another little boy cough and cry and die, I was going to do it where I could damn well rub his shoulders and stroke his hair and clean him up a little.

Maybe that makes me stupid. I don’t know.

Simon cried for half an hour when he got into our ship and got his suit off, I think mostly with relief but also some with exhaustion. He had carefully brought his rations, good boy that he was. Once he finally stopped crying, Luz showed him cat’s-cradle tricks and got him calmed down.

And then the med-ships came.

We saw them approaching the station first and hailed them. One of them broke off from the main group and approached us immediately.

“We’ve lost two little boys in the third ship clockwise in the ring from me,” I told them. “Do you know anything about what’s going on there on Chornohora? We haven’t been able to raise any kind of comms since the auto-signal went on.”

“They have no spare personnel,” said the Ganymedan medic. “I’m not sure how many are still alive, but certainly not enough to keep them out of emergency shutdown mode. It’s pretty bad.”

“What kind of bad?”

“We don’t know, but it’s hemorrhagic,” he said grimly.

“Hemorrhagic” is one of those words you never, ever want to hear used near your loved ones. I had the urge to clap my hands over my sister’s ears. But Luz had been coping with all of this just as I had, and when I turned to her, she had *her* hands over *Simon’s* ears.

That’s my girl.

The med-ship personnel were using special suits to get in and out of Chornohora, and as long as nobody started running a fever, we were low priority. They passed us supplies through the airlock. It was a really bad sign that they were not sparing any of the Ganymedan personnel to keep our spirits up—they just took Liwei and Mikko’s bodies

and left us, and brought us rations from time to time.

It was another week before they actually towed the Muspels away to a big in-system med ship and let us out of them. They were going to separate me and Luzia to talk to me, but Luz wasn't going anywhere without me. She didn't actually threaten to bite anybody, but I think the implication was clear.

The in-system official waiting for us was not Ganymedan, as I'd expected from the med-ships. She was European.

Which meant there were finances involved.

"Tereza Pinheiro," she said. "And Luzia Pinheiro, I presume, though you were not called for."

Luz jutted out her chin. "I came anyway."

"Well, girls." She looked at her handheld as if it carried new information, though I was sure she had loaded and read everything long before we'd walked in. "Looks like you could use a shower and a hot meal."

"And a beverage that isn't spruce beer or recycled water," I said fervently. "What—what's happening?"

"You have the gratitude of a grateful Chao family," she said. "So there's that for you. The seven branches want you to know that you can call on them at any time."

"Nine branches," said Luz, because in-system people don't always know.

The European glanced at her, and I saw that she was desperately trying to be kind. "No, honey. Seven."

I sat down in the ugly chair they'd provided and gripped the edge of the metal table for support. "Everyone's gone. Aren't they?"

"I'm sorry. In addition to the gratitude of the Chao family, you have an offer for a new berth. Both of you. I'll send your accounts the details. Think it over. You don't have to rush." She looked at us both carefully, greasy and stinking and smudged. "It sounds like you did the lion's share of the work keeping the other kids from completely panicking. If you play your cards right, that will serve you well in the future. Inasmuch as Chornohora has a hero, it's you."

She left us alone, left us to shower and eat and think and cry. We met up with Scott and Ferenc in the corridor, freshly scrubbed and stunned.

"Our offer is from the Gouveias," I told them all. "Our out-cousins say we can be incousins now."

"Then you'll be with us," said Scott. "I'm going to out-marry Amilcar—no reason not to, now—and we're making special arrangements to adopt Ferenc. He'll be my firstborn son, legally."

Ferenc tried to grin at that, but his mouth was only going through the motions.

"But we won't be Pinheiros any more," said Luz urgently. "We won't, will we, Tereza? They won't make an exception?"

"Honey, I don't think they can," I said.

"I don't want to be a Gouveia. I'm a Pinheiro, and you're a Pinheiro, and we were supposed to grow up and be Pinheiros together and do our own thing. I don't want to be a Gouveia!"

"I bet they'll call us 'those Pinheiro girls,'" I said. Honestly, I don't think Luzia had the least notion of how much worse things could be. We could keep the official legal name Pinheiro and get shipped in-system and not have it mean anything more than Arglebargle. Family names are like that in-system. They're noise.

"It's not the same," said Luz.

Scott bent down to talk to her, and I think he was the only one who could do it without Luz taking the opportunity to throttle him at that point. "Luzia, sweet, look. This way you and Tereza can be together, right? And you can be with me and Ferenc and Amilcar. And we'll be our own little unit inside the Gouveias. And then when we make enough money—"

Bless Scott. Bless him, oh, bless him. "That's right, Luz, when we make enough money, we can get our own ship and be Pinheiro-Nagys. And neither of us will out-marry, we'll make any men we meet in-marry or gene-donate, and we'll have the babies for the new Pinheiro-Nagy ship."

Luzia's sobs slowed to sniffles. "You promise?"

"I promise, honey."

And Scott and Ferenc promised, too, and I expect they had time to go off and cry by themselves, as I did. But mostly we focused on taking care of Luz and each other, because that was the only way we could win now. ■

MARISSA LINGEN

Marissa Lingen is one of the most prolific short story writers of her generation, selling something like 110 stories since 2000. More or less. When you publish at that rate, the only thing that's certain is that by the time this prints, the number will have changed.

She started young, with her first major success as the 1999 winner of what is now the Dell Award for best science fiction by an undergraduate student. "I've always been a science fiction girl," she says, joking that her inauguration into the field came before she was born, with her father reading science books and *Lord of the Rings* to her pregnant mother. "In utero, he was whispering to me, 'Math is easy; chemistry is fun,'" she says. "He was going to make darn sure that I was not going to have the barriers some girls get."

But it took until age 11 to realize that the fiction she grew up loving was part of a special genre. That's because her town library had shelved one of Anne McCaffrey's *Dragonriders of Pern* books in the children's section . . . and it wasn't until Lingen asked about other books in the series that a librarian let her know they were part of a genre called science fiction. "She walked me back to an entire shelf with the canonical rocketships on the spines," she says, "and the world opened up."

In college, Lingen majored in physics at a small liberal arts school with a focus on undergraduate research. She also did two NSF-funded summer projects elsewhere. But each time, her projects were put on hold by major equipment failures that left her in strange towns, with nothing to do. Her solution: read through as many Hugo and Nebula winners as she could while waiting for the equipment to get fixed. As she puts it, she figured that if she was serious about "this science fiction thing," she needed to treat it with the same dedication she gave to her physics.

Later, in graduate school, she intended to get a doctorate in nuclear physics. But every time she got excited about the science, she also got excited about how to incorporate it into a story. "That was good for the stories, but not so great for the physics," she says. So she left academics to focus on



writing. "I have been writing ever since," she says.

These days, she lives in Eagan, Minnesota, near the Twin Cities, where being Minnesotan has become a major piece of her self-identity. In part, that's because Minnesota is a big piece of her family heritage. "I'm a Norwegian girl," she says. But Minnesota is also a place with a thriving literary culture. "You have to do something with the long, cold winters," she says, "and what a lot of people do is write."

But being Minnesotan also influences her writing. "There are places you'll find it in my language," she says. "[And] I have sold several hockey stories."

But perhaps the state's biggest influence came during her undergraduate career, when her southern-Minnesota college was struck by a mile-wide tornado. It was spring break and none of the students were hurt (though there was one death in the surrounding community). But in the course of trying to find out what buildings were still standing and what the rest of the academic year would entail, she was struck by a startling divergence in the ways in which students, staff, PR people, and administrative authorities reacted.

The details of PR, administrative decision-making under stress, and a community pulling together in the face of disaster are relevant only to that specific incident. But the big picture, she's realized, is much more broadly relevant, and "Blue Ribbon," this month's story, is her first attempt to draw on that experience—delving into the question of how people "come together and fall apart" in the aftermath of shared trauma: "the way people are both better and worse than you hope."

Science fiction books may have rocketships on the spine, but the stories are, after all, in large part about what it means to be people under unusual circumstances. ■

Phenol-faerie

Jay Werkheiser

“What are you doing in the lab so late, Duncan?”

I swiveled my head around to see Gwen standing in the doorway. “Uh, just working on my dissertation research.” I shifted my body to hide the vial on the workbench from her view.

She grinned and walked over to me. “Doesn’t look like a polyamine synthesis.”

I tried to slide the vial from view nonchalantly. “Yeah, uh, it’s a side project.”

“Ooh, nice crystals. Sparkly. You recrystallize it yourself?”

Busted. I held up the vial, letting her look at the iridescent powder inside. “Promise you won’t tell anyone about this?”

She took the vial from my hand, intrigued. “It flows, almost like a liquid.” She turned the vial from side to side, staring at the sparkling dust as it flowed back and forth. “What is it?”

“Promise you’ll keep your mouth shut.”

“You know me, Duncan. My lips are sealed.”

“It’s faerie dust.”

She gave me a hurt look. “You don’t want to tell me, just say so.” She opened the vial and peered inside.

“No, I’m serious. Careful!”

“And where would you get faerie dust? The stockroom have a mythical substances shelf I don’t know about?”

“A, uh, troll gave it to me.”

She burst into laughter. Her hand shook, just a bit, but enough to slosh some of the dust onto her thumb and forefinger. “I suppose it lives under a Wheatstone bridge in the physics lab.”

“You better wash that off.” I pointed to the shimmering powder smeared on her hand.

“Oh! It’s tingly, all up my arm. What *is* this stuff?”

“I told you.”

“Dammit, Duncan, chemical exposure is serious—oh!” She wobbled, like she was dizzy and about to fall over, then lifted off her feet and floated gently toward the ceiling. I stepped back to avoid her thrashing legs. She screeched like a banshee who’d overshot her titration endpoint.

“Quiet! Someone will hear you!”

To her credit, she stopped screaming and thrashing. “Fine. How do I get back to the ground?” She bobbed gently against the ceiling, arms folded like an angry parade balloon.

“I have no idea. I only just started analyzing what it’s made of.”

She glared heat at me. “Well what’s it made of?”

“Near as I can tell, it’s low density nanoparticles of some sort. I’d love to get some time on the electron microscope, but—”

“Heh. Just try getting *that* proposal past the department chair.”

“Exactly. It has a very low solubility in water, so I imagine the bonding is nonpolar.”

“Not helping.”

“But the sparkling seems to indicate banding of electron states, like metallic bonds.”

“*Not* helping.”

“What do you want me to do?”

“I don’t know. Run a sample through the GCMS, maybe. If we can find out what it’s made of. . .”

“Good idea.” I took the vial from her carefully and injected a few microliters into the GCMS. While I waited for its results, I prepared a Nujol mull to run through IR. “Hey Gwen, looks like the GCMS is ready. Can you reach down far enough to check out the results? I’m going to run an IR spec.”

She glared at me again but pushed herself along the ceiling until she was over the GCMS readout. “Weird. It’s picking up quite a few phenolamine compounds, including dimers and trimers. But there are several unidentifiable components.”

“IR agrees,” I said. “A lot of amine and phenol peaks. Fingerprint region is really strange, though.”

“You’re the polyamine expert. How does that make me float?”

“It doesn’t.”

She looked at her levitating body pointedly.

“Well, it shouldn’t. Polyphenolamines tend to be good antimicrobial agents, for whatever good that does. Regardless, the molecules are too big to absorb through your skin.”

“But what about the smaller units, like dimers?”

“Well yeah, they could diffuse into your

bloodstream, especially when dispersed in nanoparticles.”

“What do they do in there?”

“They’re good at promoting cell growth. They enhance the activity of some neurotransmitter receptors. Some of them make the blood-brain barrier more permeable.”

“Wait. They can go through my bloodstream, get into my brain, and mess with neuroreceptors?” Her eyes went wide.

I fidgeted with the vial. “I don’t see how that would make you float. Maybe make you *believe* you can float, but—”

“That’s not very helpful, Duncan.”

“No wait, I think that’s it!”

She looked at me like I had just told her I liked the smell of ninhydrin. “You’re saying I’m floating because I think I’m floating?”

“Why not? There are quite a few unknown compounds in the dust. Some could be highly psychotropic, and the polyamines could make you susceptible to their effects.”

“So all I have to do is stop believing that I can float.”

“Uh uh. Not that easy. You’ve *seen* yourself float; how are you going to not believe it?”

“What, then?”

“It just has to run its course. Shouldn’t take more than a couple of hours to pass through your body.”

She sighed. “I don’t know. It just doesn’t seem very scientific.”

“Of course it is. We’ve made empirical observations, drawn conclusions, formulated a hypothesis. Can’t get much more scientific.”

“You know what I mean.”

“Science is all about discovering new phenomena.”

“Okay, fine. Just tell me you’re done playing with new phenomena.”

I glanced sheepishly at the witch’s brew in the stoppered Erlenmeyer flask on my lab bench. “Well . . .” ■

Nobody knows enough, but many know too much.

—Marie von Ebner-Eschenbach

WEIGHING THE NEUTRINO WITH CYCLOTRON RADIATION

Measurement of the mass of the electron neutrino is one of the major unsolved problems of contemporary experimental physics. It is conventionally assumed that the e-neutrino is the lightest of the three neutrino types or “flavors” [electron (e), mu (μ), and tau (τ)], although other scenarios are possible. Neutrino oscillation observations have provided mass-squared differences between flavors, but the mass of the e-neutrino remains a missing piece of the puzzle. All three neutrino flavors are spin $\frac{1}{2}$ leptons with zero electric charge and near-zero rest-mass. They come in matter and antimatter varieties and are usually created in weak-interaction processes in combination with their heavier cousins, the electrically charged e , μ , and τ leptons. Neutrinos interact with other matter only through the weak interaction and gravity. They are perhaps nature’s most elusive particles and can pass through a light year of lead without a single interaction.

Physicists usually discuss neutrino masses in units of electron-volts (or eV, where $1 \text{ eV} = 1.783 \times 10^{-36} \text{ kg}$). Because many neutrinos of all three flavors were produced in the early stages of the Big Bang, they could contribute significantly to the overall mass of the Universe, so cosmology implies that the sum of masses of the three neutrino flavors must be less than about 0.3 eV. Data from neutrino oscillation observations implies that at least one of the neutrino flavors must have a mass of 0.04 eV or more.

These estimates set the mass scale in which to look, but they are frustrating, because the present best attempt to directly measure the e-neutrino mass from the decay

of tritium (hydrogen-3) can only manage an upper limit of 2.2 eV, and even the planned KATRIN experiment—a large electric and magnetic tritium spectrograph being constructed in Karlsruhe, Germany—may be able to push this limit down only to about 0.2 eV. There is a gap of at least a factor of ten between what experimentalists are able to measure with currently available technology and the expected e-neutrino rest mass. A new measurement technique is clearly needed. Fortunately, a new technique pioneered by the Project 8 Collaboration has just appeared on the horizon, and we will describe this new approach in this column.

When a charged particle moves in a magnetic field, the magnetic force it experiences is perpendicular to both the magnetic field direction and to the particle’s direction of motion. This typically causes the particle to travel in a spiral or circular path. At non-relativistic velocities the number of times per second (or frequency) that a particle in such a magnetic field completes one circle of this entire path does *not* depend on the speed or kinetic energy of the particle. This frequency $f_c = qB/2\pi m$, (with q =electric charge, B =magnetic field strength, and m =mass) is called the *cyclotron frequency*. E. O. Lawrence exploited the constancy of f_c with energy to invent the cyclotron accelerator in the early 1930s. For the charged particles that Lawrence’s cyclotrons accelerated, typically protons, deuterons, and alpha particles, the size of the circular path was a few meters and f_c was around 10 MHz. However, for electrons, the circles are smaller, the frequencies are higher, and relativistic effects are important.

In particular, consider the tritium beta decay, which produces electrons forming a “bump” distribution of energies that cuts off at 18,600 eV (or 18.6 keV). The detailed shape of the cutoff at maximum energy of these electrons is affected by the e-neutrino mass, and this can be used to determine the e-neutrino’s rest mass.

In a magnetic field of 1 tesla (or 1 T), an electron with an energy of 18.6 keV orbits in a circle with a radius of 0.46 millimeters. The classical cyclotron frequency f_c of these electrons is 28.0 GHz, but because relativistic mass increase makes the electron more massive (and slower), the actual orbital frequency is $f_g = 27.0$ GHz, a 3.57% shift downward in frequency. This frequency shift depends on kinetic energy, so that an accurate measurement of the orbital frequency would constitute an energy measurement, potentially one of high accuracy.

When an electric charge is accelerated, it will radiate electromagnetic radiation. A single maximum-energy tritium beta-decay electron in its orbit in a 1 T magnetic field is a tiny antenna that will broadcast 27 GHz microwaves of cyclotron radiation with a radiated power of 1.2×10^{-15} watts, a power level that is quite detectable with modern electronics. Radiating away energy at this rate, the electron with a kinetic energy of 18.6 keV will lose energy at the rate of 7.5 eV per millisecond. Thus, in a 1 T magnetic field, a maximum-energy electron from the beta decay of tritium should broadcast a detectable radio signal showing a characteristic rise in frequency as the kinetic energy is removed by the cyclotron radiation. This should be an unmistakable signal heralding the detection of a single electron and providing a measurement of its energy. However, we note that until the present work, the microwaves from such theoretically predicted electron cyclotron radiation had never been detected.

The Project 8 Collaboration is a group of experimentalists from six institutions, including MIT and the University of Washington. The group has constructed an experimental setup with a warm-bore 1 T superconducting magnet acting as an electron trap and containing a WR-42 K-band

waveguide (a rectangular microwave transmission pipe with a cross-sectional area of 10.7 mm by 4.2 mm) into which a radioactive gas is introduced. The wave guide leads from the magnetic trap to a high-gain low-noise amplifier system designed to detect cyclotron radiation from radioactive decay electrons and to measure their frequencies and signal strengths.

The first successful test of this system has just been reported. For the initial test, the waveguide contains the radioactive krypton noble-gas isotope ^{83m}Kr , a metastable gamma-emitting isomer of stable ^{83}Kr , which has a half-life of 1.83 hours. In addition to gamma rays, ^{83m}Kr produces mono-energetic conversion electron “lines” with energies of 17.83 keV, 30.23 keV, 30.42 keV, 30.48 keV, and 31.94 keV. Cyclotron microwave radiation from all five of these electron lines has been observed and identified by the system.

Detection of single electrons is not easy. A remarkable figure in the paper shows a single 30 keV electron observed over a time period of about five milliseconds, during which its cyclotron radiation is seen to rise gradually in frequency for periods on the order of a millisecond, punctuated by more dramatic upward jumps in frequency as the electron scatters from background gas molecules (mainly hydrogen) in the system and loses about 14 eV of energy with each scattering. Thus, the non-destructive detection and measurement of electrons in an energy region that includes the 18.6 keV region of interest for tritium decays has been demonstrated.

Electron cyclotron radiation is a new tool for measuring the energy of electrons. The questions that remain are: (a) whether the low energy (i. e., high cyclotron frequency) parts of the broad tritium beta decay spectrum can be excluded in order to allow study of just the electrons near the spectrum’s end-point, and (b) whether the energy resolution of the system can be improved enough to push into the mass region below 0.1 eV and make an actual measurement of the neutrino mass rather than just setting an upper limit. Other tritium-endpoint experiments have developed ways of restricting measurements to the electrons near the end-point, and this

should be possible with the new technique. The system energy resolution depends on the accuracy with which the electron cyclotron frequency can be measured (mainly limited by noise and sampling time), and, because the measured frequency rises with time due to radiative energy loss, the accuracy with which the “start-point” of the signal can be determined. A ten-microsecond error in the determination of the start point would lead to an error of 0.075 eV in the extracted initial energy.

The energy resolution of the Project 8 system in the initial tests is reported to be about 130 eV, which is certainly not good enough for extracting a determination of the e-neutrino mass. However, this is just the first step in this completely new frequency-based technique for detecting electrons and measuring their energy. The system resolution at this level is not restricted by any fundamental limits. Further, there is a well-known principle in experimental physics that the most accurate determinations of

physical properties always involve the measurement of frequencies, so we can be optimistic.

Watch this column for further developments in this area.

SF Novels by John Cramer: my two hard SF novels, *Twistor* and *Einstein’s Bridge*, are newly released as eBooks by the Book View Café co-op and are available at: <http://bookviewcafe.com/bookstore/?s=Cramer>.

Alternate View Columns Online: Electronic reprints of over 174 “The Alternate View” columns by John G. Cramer, previously published in *Analog*, are available online at: <http://www.npl.washington.edu/av>.

References:

The Project 8 Collaboration results:

“Single electron detection and spectroscopy via relativistic cyclotron radiation”, D. M. Asner, *et al.*, arXiv preprint 1408.5362v1 [physics.ins-det], submitted to Physical Review Letters. ■

Second Birthday

Elisabeth R. Adams

The invitation was ornate: nano-ink on actual dead tree pulp. Must've cost a fortune to print. A faint number in the corner said "73." So at least six dozen more of these relics had been made. Nobody would throw them out, I thought. They were too pretty. But how many of them would be redeemed?

Probably they weren't even made on a 3-D printer, I mused. I bet they actually found someone who still grew, I don't know, pine trees, expressly for fussy rich people who insist on using real paper for their invitations. I traced my finger over the gentle embossing, the delicate gold leaf.

"Second Birthday Party," it said in gold. I rolled my eyes. First, it was ridiculous to think of them as having been born. I suppose if it had said "Second Anniversary of Decantation from a Test Tube into an Incubator" it would have taken up most of the space.

The paper's probably not pine, I realized. I peered at the immaculately bleached dead tree fibers and wondered how far back this genome went. It would be just like Erika, to make the invitations older and rarer than the ostensible honorees.

"Second Birthday Party," I read again. It continued in smaller black text in a tastefully angular font: "Sabitha and Smiley are all grown up! Come celebrate their triumph over time with a big party and cake. Monday, March 25, 2075, Longyearbyen, Svalbard. DRESS WARMLY."

I almost chucked it aside—digging up my old winter coat seemed like such a pain; it was ages since I'd needed it. And suborbital flight always made my stomach hurt.

My eyes strayed back to a single word: "cake." Oh, well, that changed things. Sven's cakes were nearly as famous as what Erika cooked up. I could almost taste the last one I'd had, at the christening. Lemon-rosemary-mint-lavender-green tea.

Mouth watering, I went down to the basement to rummage up a hat and some mittens.

The first thing I noticed when I stepped out of the parked orbiter was the cold, like smacking into the frozen side of a mountain. When was the last time it ever got this cold back in Boston? I frowned. Sometime in grad school, maybe.

The second thing I noticed were two pairs of eyes, just about level with mine. Sabitha

and Smiley had grown in the last year and a half, that's for sure. Erika was standing about twenty feet away, fussing with something small and furry in a cage, not really paying much attention to the birthday boy and girl. One of them sauntered over toward me, lazily. Sabitha. I recognized the spots around her eyes.

She must've recognized me, too, because the next thing I knew her face was nuzzling into mine. Good thing I was standing on packed snow and not ice, or she'd have knocked me over. "Hi, Sabitha," I said, skritch-ing her behind the ears.

"Oh, you made it!" said Erika. She eyed my battered orbiter disdainfully. "I wasn't sure you would, what with the high price of Pu-238 these days. . . ."

"Lisa, how wonderful to see you," said Sven, emerging from the house. He smelled of flour and sugar when we embraced. "I made a special cake, just for you. A pre-cake, before the main one tomorrow. Come inside, tell me what you think."

Flanked by Smiley on one side and Sabitha on the other, I walked into their house.

"I was sorry to hear about the mammoths," I said to Erika. I closed my eyes and took a bite. Bergamot. Persimmon. Cassia, not cinnamon.

"Well, I'd be sorrier for the elephant, if you asked me," said Sven. "Elephants. Do you like it?"

"Mmm," I said, mouth full of cake. I flashed him a smile and chewed. "I'm surprised they let you try with as many elephants as they did."

"I had three more cows lined up for the next attempt, but then there was that disaster at the Kenya preserve, and suddenly all the modern elephant breeding programs were buying up my specimens," said Erika. She almost choked on the word modern. She had never cared much about the recently extinct.

"I heard they saved several gene lines," I said.

"Sure, whatever," said Erika. "But I was this close to solving the tusk expression timing problem. . . ."

"Saffron," I said to Sven. "You put just a touch of saffron in this." Sven beamed.

"So how is your little blog coming?" asked Erika. She probably didn't mean it to sound condescending.

"My food review column is going well," I said. "Though I keep getting requests from unsavory editors who know that we're friends. They, ah, want me to do a special series on. . . ." I trailed off. I didn't know how to put it.

"Mammoth burgers?" said Erika. "Dodo egg omelets, with a side of smilodon bacon?" She had one arm on Smiley's neck as she said this, gently stroking his tusks.

"Well . . . yes."

"I get these requests too, you know. Especially after the last failure. The fourth batch of mammoths miscarried near full term, you know, and baby mammoths are so big."

"Lots of meat on them," joked Sven. He was dicing vegetables for dinner. Some kind of soup.

"You didn't. . . ." I said.

Sven and Erika shared a look. "No," said Sven. "Of course not. There were all those tests to be run to figure out what went wrong. Mammoth stew, what an idea," he chuckled.

I laughed a little too. Well, I could at least tell my editor I had asked. I watched as he took a giant egg and broke it in the pot.

"Great Auk, on the other hand. . . ." he said with a wink. I remembered seeing large colonies on the flight in.

Oh.

The party the next day was a little anticlimactic. About a dozen people showed up, out of 128 real-tree invitations. Erika didn't seem like she had expected more. Sven still baked as if a few dozen orbiters could descend at any minute, which was just fine by me. Most of us didn't know each other, and we just stood around making awkward small talk and eating cake.

It turned out the small stand of trees near the door were in fact the ones used to make the invitations. *Acer smileyi*, a kind of maple not seen in the wild since the Miocene. Erika had picked it because she liked the name. Of course.

Finally Erika broke out her latest successful reproduction, to much *oobing* and *aabing*: a pair of ground sloths.

"I love my new incubators," she said. "I'm never messing with live surrogates again. After

all, look how well Smiley and Sabitha turned out," she said, pointing at the guests of honor. They were currently confined to their cage while the ground sloths were exhibited to the human guests and sat nonchalantly uninterested in the proceedings. Except that their eyes were tracking the ground sloths' every motion.

"Thanks to my latest grant, I can now pop out a pair of sloths every week," she said.

"That's fantastic!" said a young man who I didn't know. He was affiliated with some news site. "I know some people at the Dakota Wildlife Preserve who would love to start a colony. Have you sent them any specimens?"

"Well . . . no, not yet," said Erika. "Too many transcription flaws in the first few batches, not enough diversity. Not at all suitable for the founders of a new population. Although these latest ones aren't bad . . ."

I watched as the sloths slowly wandered over toward the caged smilodons. Not very good survival instincts.

And indeed, it was all over in a flash. Sabitha had been toying with the lock on their cage and with no warning it snapped open. The ground sloths registered the looming giant tusks moments before their jugulars were pierced. Blood that had last been spilled thousands of years ago once more wetted the teeth of two very happy saber-toothed cats, who messily fell to their birthday meal.

"I was hoping they'd at least wait until after cake," said Erika, miffed. "I was pretty sure the lock would keep them busy longer."

The stunned guests began to applaud. I could see the young man subvocalizing his report. Something about nature red in tooth and claw, unless I had badly misjudged his literary aspirations.

Then we all had more cake.

I was prepping the orbiter the next day when Sven stopped by. He had a small white box wrapped up for me. "Leftovers," he said. I beamed. We both watched as Erika ran in the field with her smilodons. She had released a few miniature reindeer, with bright red noses. Christmas leftovers. Smiley and Sabitha bounded gleefully after them.

"It meant a lot to her, that you came," said Sven.

"Friends are friends," I said.

"She wanted me to ask . . ." He looked embarrassed.

"No," I said. "I have no plans of returning to the lab. I like eating cake for a living." For one thing, the cake never tried to eat me.

"You don't have to convince me," said Sven. He turned to leave, then stopped, remembering something.

"Oh, hey, has she told you about the next launch, in June?"

"In Christchurch?"

"No, not the moa and eagle program, that's not for another six months or more. No, this is her pet project, the one you talked about all the time in grad school. She thinks she's got the feather expression all figured out. Her last grant came fully funded, and they finally agreed to a legal contract for the lease. Operation Easter Island is a go. She wanted to know if you would come to the dedication ceremony. . . ."

Oh, I thought, my eyes filled with visions of velociraptors. "I don't know. . . ."

"I'm going to be working on my pies," said Sven.

Well. Pies. That was different.

"I wouldn't miss it." ■

The Badges of Her Grief

Andrew Barton

"Unfit day out here!" The soft voice cut through the blizzard. Eun-jin Park pushed through the whirling snow to find Sarah Qaummalak wrapped up in a dusky parka with the hood down and standing beneath a pulsing orange beacon. "I'm impressed you made the trip at all, Ms. Park. You must really want to say hello."

For a moment, despite the chattering cold that she'd come to expect after three winters on Esperanza, Eun-jin stared at the other woman. Was she already trying to set herself up as that much better, so much more elevated than the freelance writer who had to dig through life wearing boots filled with snow? No one she'd asked had given her a straight answer on what Qaummalak was doing. Today, standing strong against nature's fury, tomorrow . . . that was for Eun-jin to discover.

"Wherever the call brings me," Eun-jin said in a sunny tone, though the cold was enough to make her liberation necklace feel like an icy fist pressing against her chest. She would have to be careful—the trick wasn't to hide the truth behind a smile, but to keep the other person from realizing there was something

to find behind it. "Though I suppose with conditions like these, it'd have been advisable to disappoint the call for a day or two."

"Don't worry!" Qaummalak motioned her toward the building, a quick-build prefab the size of a small warehouse, big enough that its corners were swallowed in blowing snow. "'Conditions like these let us test ourselves' and all that. Come on, get yourself inside and warmed up, and you can say all the hellos you care to."

Qaummalak pushed the door open, and Eun-jin walked into a room that was at peace. Paintings of landscapes and cityscapes hung from the walls next to half a dozen doors. Shelves held flowering plants, rough-carved statues, an aluminum tea set and a few hard-copy documents, and in the center was a smooth circle of dirt topped by a small pile of rocks arranged in a humanoid shape. It gave the room an earthy smell, a reminder of what the world outside would be like after the thaw. Eun-jin took off her coat and boots and followed Qaummalak to a corner set aside as a sitting room, with two thick-cushioned wood-frame chairs facing a table where a teapot blew out fingers of steam.

"Looks like all the comforts of home," Eun-jin said. Her gaze lit on a sconce across the room. A four-armed candleholder stood flanked by two books leaning open, and a Buddhist dharmachakra was painted in yellow, red, and black on the wall behind them. "You've certainly set yourself up well out here."

"I suppose you're wondering why," Qaummalak said with an enigmatic smile as she poured out the tea, filling Eun-jin's cup first. Vindurvik Violet from the smell, hardly her taste but part of traditional Esperanzan hospitality—if there was such a thing as real tradition on a planet where humans had lived for scarcely forty years. "I'm not sure if you'll find much worth remarking on amid what I do here. I'm sure the rumor mill has been filling in the gaps, but really, I'm just laying a foundation."

"Xenopharmacology holds a lot of promise," Eun-jin said. Esperanza's ancient terraforming hadn't just produced a familiar biosphere, but it had provided a lifeboat for species whose time on Earth had ended with a climate shift or a logger's blade. "Plenty of people back ho—back on *Earth* are interested."

"I'm only asking questions," Qaummalak said. "The strewth know the possibilities of the natural pharmacy well—the same kind of trial-and-error science that we had to do back before technology. If we're going to stay on here, we need to learn from them. It's their world, after all."

"I don't imagine there's a ticket back to Earth in anyone's future," Eun-jin said, and she took a sip of tea to hide her sour expression. She wasn't one of the exiles sent to the far reaches of human space to keep them from making trouble back home, but that hardly made a difference anymore. "In that case, what do the strewth say?"

"Why don't you ask them yourselves?" Qaummalak motioned toward a large, smooth, wooden door. "I've got an enclosed range just for them. They shouldn't have to shiver through this weather anymore. We can at least do that much."

Eun-jin, for her part, was thankful to leave her tea unfinished. She watched Qaummalak wave her hand above a reader mounted next to a lone door on the far wall, and after a

moment, there was a soft click. The door swept inward, and Eun-jin found herself looking into a backland forest in midsummer. The smell of fresh needlepines and trodden soil, the sounds of chittering grizzly rabbits and marauding buzzflies, and the look of a world that seemed far too real to be contained inside a field tent stopped her for a moment, until a couple of strewth wandered their way from out of the bushes.

"Hello hello," said the bigger of the two in a sharp, throaty accent—a female, from the size. Eun-jin couldn't help feeling self-conscious in front of strewth. Not only because humans had left nothing save scattered bones of their moa cousins, but at the way they'd been pushed back, fenced in, and tied up in the decades since the first landing. Even three years after strewth sapience had been discovered, far too many people still treated them as clever animals with the gift of gab. "Haven't seen you before. I'm Kuai. Give your name?"

"Eun-jin," she said, her head spinning. The artificial forest felt much like something she'd expect to find in the Pyongyang Zoo—except the zookeepers back home didn't have to worry about their charges talking back. "I didn't think you'd be here. What have you been doing?"

"Telling and learning, so blessed," Kuai whistled. Eun-jin frowned at that—how much was there to learn about behind a locked door? "There's so much to tell. So much to learn."

"The strewth aren't prisoners," Qaummalak said. They'd reconvened to the reception room, leaving the strewth to themselves—at least there was *some* place on Esperanza they could be free of humans, at least for a short time. The field tent had felt too much like a decorated cell to Eun-jin. "In fact, they're my collaborators. None of the work I do here would be possible without them."

"I'm sure it wouldn't," Eun-jin said. "But I'm sure there are many who'd ask why you have the strewth come to you, and not the other way around. People trying to understand the chimpanzees and the dolphins lived on their terms—they didn't lock them in a laboratory like experimental mice."

"Kuai and the rest are ronin. Outcasts from regular strewth parliaments for one reason or

another. In the old days, before we showed up, they would've died quickly. I can give them sanctuary here."

"Quite a sanctuary it is." Eun-jin took another look around. The contents had clearly rolled out of a 3D printer in town, with only a handful of pieces bearing the battered look that came with a voyage of one hundred and thirty light-years. "I'm curious where you found the support for a setup like this."

"I'm a volunteer settler." It took all of Eun-jin's self-control to keep astonishment from shattering her eyes. Volunteers had the warm fields of Mirabilis, the sunsets of Liaoning, or the graceful winds of Matumaini all for the taking. What could Esperanza offer in that exchange—a lifetime supply of ice? "Sponsored by the University of Nairobi, actually. The strewth are the most intelligent beings we've found off Earth so far. We haven't even begun to get at what they can help us understand, and how we can work together."

"I see." How many times in Earth's spattered history had colonizers walked with such high-minded rhetoric, hiding obliteration and slaughter beneath words of friendship and community? "Would it be all right for me to speak to them directly? It's that sort of perspective that people back home are really interested in."

"Of course. I know that they have plenty to talk about." Qaummalak rose and waved at the reader by the door, and the click that answered her spoke louder than she ever could—if the strewth weren't prisoners, *why* was there a lock on their door?

"I'd like to go in there alone, if you wouldn't mind," Eun-jin said. "I'm sure you understand."

"Certainly, it'll give me the chance to see to some work. Just call if you need me." Qaummalak nodded and pulled the door closed. From this side, it was a strange interface between the worlds of human and strewth, with the walls around it camouflaged as deep interior forest. No strewth came to greet her this time, and though she could hear their chattering in the distance, they'd had millions of years to perfect blending in.

"Kuai, are you there?" She took an experimental step and found the dirt authentically soft and warm. "It's Eun-jin. I'd like to talk."

"Humans always like to talk." Kuai emerged out of nothing, her long thin neck having

stood in as a narrow trunk. "Talk and talk and talk. Like you have nothing better to do."

"How about you talk to me?" Kuai's long neck put her head on an equal level with Eun-jin's. "About what's going on here, about the sort of things you're learning. Would that be all right?"

"Plenty of room between the trees," Kuai said. "So talk. Ask. Go on."

As she drew breath to speak, Eun-jin found herself frozen. Here she was, about to interview an alien—*alien!*—and yet she'd been more rattled when she'd interviewed the president of Cascadia. Sure, Kuai wasn't the leader of twenty million people, but at least humans offered common ground. What did a strewth look like when it was irritated, sad, or happy? Was *that* where the resistance to acknowledging their sapience came from, that the strewth were just alien enough to not register as people? Eun-jin shuddered at that. She wouldn't have wasted her time interviewing an animal. When she was done, Kuai's would be another voice in the argument to settle strewth sapience.

She started out with the basics. Kuai had once been a working strewth destined to pull farm equipment, but had managed to escape and melt into the wilderness. She showed Eun-jin the scar where she'd dug out her GPS tracker with beak and claw. It was uncomfortably reminiscent of wounds she'd seen replicated in the Northern History Museum, the ones carried by survivors of the gulags built by the old, mad religion of ideology.

"You've come a long way," Eun-jin said. "Why are you here?"

"It's cold outside. No parliament, no camp, just us. If there's luck, we don't freeze or be eaten by daggerteeth. Sarah came to us before, said she would give us a safe spot if we talked about what sort of plants help, what sort of plants hurt, what sort of plants kill. Some of the plants, trick a daggertooth into eating it and then we get to eat the daggertooth. What goes around." Kuai tossed her head to the side—was that a mark of frustration, or was she just painting whatever assumptions she could in an attempt to understand?

"Would you say you're treated well?" Eun-jin kept her tone neutral. "That Sarah's been dealing with you fairly? Considering what other humans did to you."

"All humans aren't assholes," Kuai said. Eun-jin had to stop herself from smiling—whatever she expected from the interview, a strewth using casual profanity hadn't been it. "We have a safe spot, lots of food around, no dag-gerteeth worry. Peaceful. Can I ask you a question?"

"Sure, that's one reason I'm here."

"Do you believe in God?" Kuai blinked quickly and leaned in toward her. "Sarah has been teaching us about God and religion and stuff, but some of us wonder if she's being funny. Do you really believe like it says in the books?"

"I—I *did*, a long time ago." A century and a half after the fall of the Kims, cultural fault lines still divided her North and the South. Faith was far more common south of the long, narrow park where landmines lurked still, but her parents had found something worthwhile in it. Something she'd only understood as a way to keep her under control. "Many humans still do. Billions and billions."

"Dang," Kuai said. "Why? You know so much. You know how to fly here from across the stars. Why keep to believing in God? The one who put the tracker in me talked about God a lot. I didn't know then. Talked about how God created the world. I think that's strange. Why don't humans?"

"It's very complicated," Eun-jin said. God *damn* her! Didn't the strewth have enough problems already? Wasn't it enough that aliens had fallen out of the sky and started to transform their world right in front of their eyes? "What sort of things has Sarah been teaching you?"

Kuai seemed happy to take Eun-jin through it, though she could've been angry or frenetic for all Eun-jin could tell. While there didn't seem to have been any drive at out-and-out conversion, with the strewths' education focusing on an overview of traditions spanning the gaps from Shinto to Christianity to abandoned pantheons and commercial cults, it still rubbed her raw like an ill-fitting shoe. Today it wore the cloak of "education," but how long would it be until a spaceplane disgorged earnest men and women who would work until the strewth believed what humans wanted them to believe?

The interview drifted back into more familiar ground from there, but she couldn't get

her heart in it. The idea of teaching pretechnological aliens about the Genesis creation story, when they lived on a terraformed world that some people held up as an example of God's work, left an iron taste in her mouth. She rubbed her liberation medal with one hand—if only those who had pushed the Japanese out of Korea had known just *what* their "liberation" had made possible in the years that followed.

"Thank you, Kuai." Part of her wanted to lean in and whisper a plan to get them all out of here, to make them free again, regardless of the lack of any plan more complicated than "run." It would've been easy for them to lose themselves in the snow—they'd dealt with it for millennia before humans arrived, after all. "You've given me a lot to consider. I appreciate it."

"Welcome," Kuai said. "Thanks for telling. Humans are too strange, you know."

Liberation. It was a word that would have had no meaning in Eun-jin's ideal world, where there was nothing so odious that people needed to be rescued from it. All too often, one person's liberation was another's enslavement—how many people, how many *humans*, were putting strewth to work to "liberate" them from the state of nature? She rubbed her medal again, still bright despite having been forged two hundred and fifty years before. There were always those eager to forget so that they could repeat old crimes with clear heads.

"Ms. Qaummalak." Eun-jin couldn't deny nervousness at confronting her so soon, in her own facility, before telling anyone or even leaving any notes about what she'd learned. It was a gross violation of hospitality for a host to harm a guest—but weren't the strewth guests just as much as she was? "We need to talk about what you're doing to the strewth."

"Is that so?" Qaummalak looked up from her tablet with a raised eyebrow, almost mocking. "I wasn't listening in, no please, talk away."

"You're—you're *domesticating* them!" She spat the word after a moment of indecision. Visions of strewth raised as clever pets for the children of Earth flickered behind her eyes. "Trying to turn them into humans with beaks, because you're so sure you can save them from themselves!"

"Are you quite finished?" Qaummalak's voice was as cold and smooth as Atataikai Bay in mid-winter. "It's obvious enough you came here hoping to find something breaking, and I'm glad to see you're so invested in what's going on. If more people were like you, Esperanza would be a better place. The problem is, you're—"

"I'm not the problem here! You're the one who's rearranging an alien society so that we don't have to adapt to them. You're the one filling their heads with religion."

"Yes, I am, along with other things," Qaummalak said. "It's not as if I was ever hiding it, and you didn't have to manipulate Kuai into telling you. But did you ever stop yourself and ask *why*?"

"I—" Eun-jin took a step back. What was her game, standing with such a self-assured calmness? "It's obvious—control. The same reason colonists spread religion back on Earth. Come on our team, and get answers to all the mysteries of life."

"Appropriate that you'd put it like that." Qaummalak fixed her with a wide, bright grin. "Tell me, Ms. Park, what did I just do?"

Eun-jin tilted her head forward and aimed a disbelieving gaze at the other woman. "You smiled. What's that got to do with anything?"

"Correct, but superficial," Qaummalak said. "What I *did* was flex facial muscles to reveal my teeth and demonstrate that I was in a good mood. But imagine if you couldn't read faces. I've just shown you the tools I use to chew my food. Does it mean I'm about to eat you? If a strewth saw a daggertooth smile at them, that'd be a logical conclusion."

"So you're teaching strewth what it means to believe." When Kuai had asked her about her own belief, the strewth had seemed skeptical, as if she couldn't believe Qaummalak was dealing honestly with them. A few concepts, introduced into the group for evaluation and acceptance or rejection—that was it, it had to be. "You're vaccinating them."

"We're as alien to the strewth as they are to us," Qaummalak said. "They're still figuring out what to expect from us. Think about all the unbelievable things that humans did out of belief—the Flagellants, say, or what happened on Pallas. When they understand our religions intellectually, they'll understand us, and that's the key to the future."

"Anticipating us?"

"*Resisting* us." Qaummalak bowed her head and lifted off an understated cloth necklace, so light and thin Eun-jin hadn't noticed it, from which a small medallion hung. "I think you carry something like this yourself, Eun-jin. I've seen you reach for it when you thought I wasn't looking."

"It's only a reminder," Eun-jin said. Many soldiers of the North had received one, Liberation Tower wreathed with light and laurels on one side and the date of the liberation on the other. "What's yours?"

"The same," Qaummalak said, offering it in an open palm. The words ESKIMO IDENTIFICATION CANADA were written around the edges and a crown was etched in the middle. There was partial writing beneath it, E5-23, but the rest was scratched and unreadable. "This was made for one of my ancestors, two and a half centuries ago. In the old days my people had no surnames, but when Europeans came they were determined to change that. Those numbers became part of my ancestor's name."

"It seems like the kind of name you'd give to a machine," Eun-jin said. "Something not worthy of consideration."

"It wouldn't surprise me," Qaummalak said. "We think we're so much better than we were, so elevated . . . our engines and implants don't change who we are, don't eradicate what we've done. When I look at the strewth, I see people who don't know what they're dealing with—who might not know until it's too late, until we've decided they need to be saved from themselves, until we steal their land out from underneath them, marginalize them when they resist, and squeeze and squeeze until they *become* us. We can't let it happen again. I can't. So I teach them about who we are, so that when the day comes, they'll be ready."

Eun-jin couldn't help but be warmed by Qaummalak's quiet fury while the last of her own indignation drained away. It was clear enough that as long as strewth were seen by humans as clever animals, they would be tolerated as curiosities; few people felt pangs of conscience about roosting an animal from its territory. Sapient people posed another problem entirely—but how often had whole peoples been slaughtered for territory? Her fellow humans would no doubt find tears to grieve *after* the strewth were dead.

"If that's the case, you can count on my silence," Eun-jin said, passing Qaummalak's medallion back. "As long as you let them out. You can't make those arguments while keeping them locked behind a door."

"Like I told you before, they're my collaborators, not prisoners," Qaummalak said. "The door is only locked on this side. They decide if they want to let *me* in. Kuai, would you like to come out here and demonstrate?"

The door opened with a quiet whisper and Kuai strode in, though she stopped to wipe the dirt off her feet.

"Sorry for not telling you they were listening," Qaummalak said with a grin. "I couldn't miss this kind of educational opportunity."

"We're not prisoners," Kuai said. Someday soon, Eun-jin would have to learn what triumph looked like on the face of a strowth. She could find *someone* to run that story. "We're free." ■

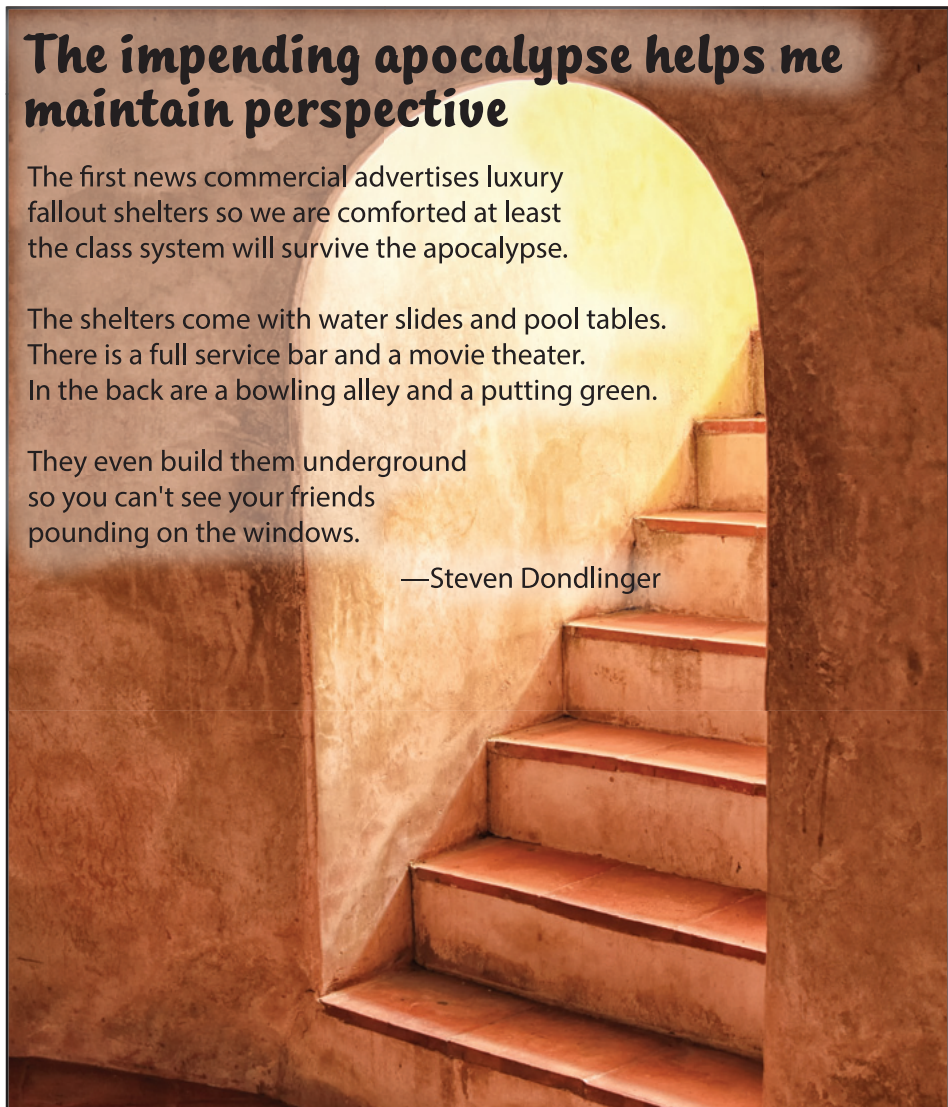
The impending apocalypse helps me maintain perspective

The first news commercial advertises luxury fallout shelters so we are comforted at least the class system will survive the apocalypse.

The shelters come with water slides and pool tables. There is a full service bar and a movie theater. In the back are a bowling alley and a putting green.

They even build them underground so you can't see your friends pounding on the windows.

—Steven Dondlinger



An Immense Darkness

Eric James Stone

Like most nights over the past few weeks, Antonio stays in the lab for hours after his coworkers have gone home to the people they go home to.

The person *he* used to go home to isn't there any more. She isn't anywhere—there wasn't even a body to bury. But an echo of Shanisha lingers here at the lab, so he stays.

Tonight's a good night. Whatever project the astronomy department was working on for the last five days seems to be over, so there's enough number-crunching capacity in Texas State University's supercomputer to run the brain simulator in almost real time. Antonio starts the base program, then loads Shanisha's file.

He hesitates too long about whether to turn the speech option off.

"Hello? Who's there?" At less than real-time speed, the voice coming from the speaker doesn't sound right. The speech algorithms adjust the pitch, but they can't stop her from sounding slow, like she's struggling to think of the right words, like her mind's not all there. Which it isn't.

The real Shanisha was brilliant.

"Hey, babe, it's me," says Antonio. "Running a calibration test, so just relax."

"Is the other me there?" she asks.

"No, she's out of town."

"The Miami trip."

"Yes." He doesn't want to think about Miami. "So don't worry—she can't catch you flirting with me."

She giggles. "Tonio, you are such a bad man."

They talk for almost an hour before her mental matrix loses stability, and he's forced to end the simulation. Shanisha's file is several months old, recorded before she wrote the code that integrated self-correcting feedback algorithms into the matrix during the brain scan. They never got around to recording her again, always too busy perfecting the process to waste time making another imperfect copy.

He reloads her file and starts again. She doesn't know she's dead. And for a while he can forget, almost.

Antonio wakes as someone enters the lab. His cheek is hot and sticky from the vinyl of the couch where he slept. Jodi Lee just shakes her head at him as he sits up and straightens his cramped legs. He can't remember if this makes two nights in a row he hasn't gone

home, and he sniffs at his armpits. Bad. If today is Wednesday, he has a neuro-cybernetics class to teach.

He checks his cell phone. It is Wednesday, and he has seven unanswered calls and three new voicemail messages. They can wait.

"I'm going home," he says to Jodi.

"Good," she answers, without looking up from her workstation.

Before he gets to the door, a pale, blonde woman in a navy blue suit opens it. Her eyes flicker down, then up to meet his. "Dr. Antonio Reyes?" she says, a dash of New York City in her accent.

"That's me," he says.

"Wendy Bricker." She holds out a hand for him to shake. "I'm with the U.S. Attorney's office in New York."

He shakes her hand by rote and looks at her blankly, unsure why a lawyer has come to his work. The patent case was settled out of court last year, and he hasn't had so much as a speeding ticket since he was seventeen.

"I tried calling," she says. "Office, home, cell."

"I've been busy," he says.

"Could we speak in private? Your office, maybe?"

Her heels clack on the tile floor behind him as he leads the way. Could she be here about Shanisha's death? He had no more information about that than anyone who watched the news.

He points to the spare chair in his office, and she dusts it off before sitting, crossing her legs.

"How can I help you Ms. . . ." Her name has slipped from his mind. He sits at his desk, then turns ninety degrees to face her.

"Bricker," she says. "I understand you have developed a method for scanning people's minds."

"Not just me," he says. "My whole team." Which now has an unfillable hole in it.

She gives him a brisk nod. "Your team. We need to use your technology to read someone's mind."

"No," he says. "It—"

"This is a matter of national security, Dr. Reyes." She leans forward, her blue eyes earnest. "Millions of lives could be at stake."

"Doesn't matter," he says. "This isn't a device for reading anyone's mind. It makes a digital copy of the brain. That digital copy can

then be run in a simulation. It's a way of studying how the brain functions, not telepathy."

"But once you've made the copy of the brain, couldn't you just search for certain information held inside it?"

"There are a hundred billion neurons in the brain, some of which have thousands of connections. Our understanding of how all that works to create memory and personality is still rudimentary. You're old enough to remember when music came on CDs, right?"

She nods.

"Imagine looking at a CD in order to figure out what notes the violin in an orchestra is playing. Impossible. But put it in a CD player, and you get a symphony. Our brain scan is kind of like a CD of a brain: you can't just pick the data out of it. You have to put it in the brain simulator." Realizing he has gone into lecture mode, Antonio shuts up.

"So if you scan someone's mind and put it in the brain simulator, could you extract the information?"

"If the brain can remember it and is willing to communicate the information, yes. But in that case, it's probably easier to just ask the person." He shakes his head. "I know that's not what you're looking for, but it's not like we have a mind scanner we can put on street corners to look for people thinking terrorist thoughts."

He can tell how much he has changed in the past twenty-five days because the idea of such a device does not fill him with repugnance. If having mind scanners in Miami would have prevented Shanisha's death, he would gladly let his privacy be invaded.

"That's not what we need," says Bricker. "But unfortunately, it doesn't sound like what you have will work, either. I'm sorry to have wasted your time." She gets to her feet.

"Sorry I couldn't help," he says.

Bricker pauses as she opens the door. "Dr. Reyes, I just want you to know I'm doing the best I can to bring the terrorists who killed your fiancée to justice."

"This brain scan you wanted, it's for that case?" he says.

She closes the door and turns back to him. "You didn't listen to the voicemails I left?"

"No." His face grows warm with embarrassment. "I haven't been paying much attention to things lately."

"You've heard that we caught Abdul Motaali Al-Razi?" At his blank look, she adds, "The mastermind behind the nuke in Miami."

"I hadn't heard," he says.

"Three days ago, in New York. It was on all the news." She seems incredulous that anyone could not know.

"And it's his mind you want to scan?" The mind of the man who killed Shanisha—what darkness looms inside it? Even knowing it is foolish, Antonio imagines a black cloud appearing in the scans.

"His associates claim to have more nukes. Any details he could give us could prevent another Miami. But he's lawyered up and won't say a word. I read an article about your work in *New Scientist* last year, and I figured it might be worth a shot." Her brow furrows. "I seem to remember something about the brain existing in a virtual reality."

"Yes, we do that so we can examine how the mind interacts with the senses. It also allows us to communicate." Communicate? What would he say to the man who had killed Shanisha, along with a quarter million others?

"Would it be possible to create a virtual reality in which Al-Razi believes he has escaped custody, so he contacts—"

"No," Antonio says. "The simulation isn't that good. There are videogames on the market that are better. Even those, you can distinguish from reality. The brain knows it's a fake environment."

"There must be some way to extract the information," she says. "We can't let it happen again."

"Wait," he says. Rage he did not know he felt seeps up inside him. "There are ways to make someone talk, right? You could force him to reveal what he knows?"

"Dr. Reyes," she says, "I don't know what might have happened had the military or CIA captured him quietly. I don't think I want to know. But he was captured in a very public raid by the FBI, and he has a team of lawyers. We can't torture the information out of him. We can't even ask him a question without his counsel present."

Antonio smiles. He hasn't smiled in weeks, and his smile feels wrong. "Have you ever played videogames?"

She frowns. "Of course."

"Ever play a videogame where you go around shooting at people? They're called 'first-person shooters'?"

"Yes. I've only played a few times, but my brother's really into them."

"Your brother ever kill anyone in those games?"

She chuckles wryly. "Hundreds at least. Maybe thousands."

"And as a consequence of all those hundreds, maybe thousands, of killings, has he ever been arrested for murder?"

"Of course not. No actual human beings were killed."

Antonio nods. "Precisely. They're just simulations, not real. Ones and zeros inside a computer. A scanned brain is the same: just data. Like a video game. It could be a videogame of interrogation. No lawyers to stop you asking questions. No civil rights groups monitoring treatment. And I can create virtual sensory input of any kind."

She purses her lips for a moment, then says, "I thought you said the brain could tell it was fake."

"Consciously, yes. But the brain still sees light where there is darkness, hears sound where there is only silence." He leans forward. "Feels pain where there is no body."

Ms. Bricker does her job well, and a judge rules in favor of allowing the scan, on the theory that potentially preventing another terrorist nuke against actual humans outweighs any possible harm done to a computer simulation. News pundits weigh in on both sides, but Antonio doesn't pay attention to them.

Federal marshals fly Al-Razi to Texas and escort him to Antonio's lab. Antonio stays in his office—his team is capable of conducting the scan without him. Sitting at his desk, he closes his eyes and wonders what it would be like to be a brain in the simulator. From the beginning, the system had been designed to present the brain with sensory stimuli through a virtual world. It had not been designed with simulated physical pain in mind, so that would require some new programming.

However, new programming might be unnecessary. It would be a simple matter to block sensory input from the virtual world. It would be better than the best sensory deprivation tank ever built: no sight, no hearing, no

touch, no taste, no smell. But that was not all: no equilibrioception, the sense of balance and acceleration; no thermoception, the sense of temperature; and no proprioception, the sense of where your body parts are in relation to each other.

What would a mind do cut off from all such input? How long would it be before that mind was desperate enough to do anything in order to receive some feedback?

With the government having requisitioned the full use of the university's supercomputer, the simulated brain could be overclocked—made run at up to eight times its normal speed.

"They've finished," says Bricker.

Antonio opens his eyes to see her standing in the doorway.

"How soon before you can get the interrogation programming online?" she asks.

He sits up and leans forward. "While I'm working on that, we can start with a different approach."

After just over a day of real time—ten days of the simulated brain's subjective time—its computer-generated voice pleads for contact. It cannot hear its own screams, but Antonio can, and he turns down the volume so as to not disturb the others in the lab.

Bricker begins to question it about additional nuclear bombs. Her voice is the only sensory input allowed through the blocks, and the brain responds, claiming to be willing to do anything she wants.

Antonio does not stay for the questioning. He is not certain that the sensory deprivation will succeed, so he works on creating the perfect torture environment, one that simulates every one of the tens of thousands of pain receptors in the human body. He creates a control panel that will allow the sensation of pain to be localized or general, strong or mild. With all the receptors set to maximum, it will cause pain beyond anything any human being has ever experienced.

But it will just be a simulation of pain in a simulation of a brain. Nothing more than that.

Hours later, Bricker finds him in his office. "We've located and secured two more bombs. We think that's all of them."

"I'm glad," he says. "What do you want me to do with the simulation?"

"You can turn it off." She pauses. "Although, maybe we'll need it again. Can you save it in its current state?"

"Yes. We'll also have the original file on hand in case you need to start from scratch for some reason."

"Our country owes you a great debt." She reaches out a hand, and he stands and shakes it.

"You're welcome," he says.

She walks to the doorframe, stops, but does not look back at him. "What's in there really is just a simulation, right? Just ones and zeros, right?"

He nods. "Just ones and zeros."

"Right," she says.

Her heels clack in the hall as she walks away.

Antonio resists temptation for two nights, but on the third, he finds himself alone in the lab shortly after one A.M. He thinks of loading up Shanisha's scan in the brain simulator and talking to her, as he has done so many times before. Instead he types the command to load Al-Razi's scan—the one that had already run for days of internal time—inside the sensory deprivation environment.

He tells himself he just wants to know why a man would do what Al-Razi did, why Shanisha died, and then he'll turn it off.

Other departments are using shares of the supercomputer's processing power, but there's enough to run the simulation at normal speed.

"Mr. Al-Razi?" Antonio says.

"Please," an accented voice replies. "You promised to end this torment if I answered your questions."

"I'm someone different. You haven't answered my questions." Antonio drew a breath. "Why did you do it? Why kill so many innocent people?"

"You Americans always think you are innocent."

"Shanisha never did anything to you."

"Your government bombs my people, invades our lands, oppresses us at every turn."

"She never did any of that. She wasn't involved in government."

"What was it your President Lincoln said: 'government of the people, by the people, for the people?' Who is to blame for the actions of

your government? The people who chose that government. As long as America oppresses my people, none of you are innocent."

Antonio doesn't know how to respond, so he shuts off the microphone. He isn't sure what he had expected. An apology, maybe? Or the ravings of a madman. But Al-Razi's rationalizations make him uncomfortable. He doesn't want to hear justifications.

He wants to hear Al-Razi weep with remorse.

Beg for mercy.

Scream.

Bricker had gotten what she needed without using the torture environment Antonio had programmed. Maybe with time, the sensory deprivation environment will get Antonio what he wants. But he is impatient, so he loads the torture environment.

With only 10 percent of the simulated pain receptors at maximum, Al-Razi begs him to stop. "I'm sorry! I'm sorry! I'll do anything you want."

But this does not satisfy Antonio. What he truly wants—Shanisha back—is not something Al-Razi can provide.

At 40 percent, the screams become incoherent. In a physical body, overloading the pain receptors like this would cause feedback loops that block some of the pain, but there is no simulation of such an effect.

The screams make Antonio feel a little nauseated. This is just a simulation, he reminds himself. He turns off the speakers, but doesn't turn down the pain levels until about fifteen minutes later.

Over the next three weeks, Antonio gets to the point where he can listen to the ragged screams at 100 percent, followed by the insane gibberings after he dials the pain back to zero. The brain simulation is irreparably damaged by such treatment, so he repeatedly restarts the Al-Razi simulation from its pretorture status, experimenting with various escalations to see how long he can draw things out before the simulation goes insane, or how quickly he can do it.

He wishes there were some way to make the real Al-Razi feel what the simulation feels.

As usual, Antonio stays in the lab for hours after his coworkers have gone home. He starts the brain simulator, then loads the brain-scan file.

"Tonio?"

Antonio's heart pounds. It is not supposed to be Shanisha's voice. He looks at the screen and sees he accidentally loaded her file, not Al-Razi's.

"Something's wrong," she says. "It's completely dark, and I can't even hear my own voice. Can you hear me?"

He types quickly, trying to remember how to load the default environment.

"Is anyone there?" she says.

Antonio flicks on the microphone. "I'm here."

"Oh, good," she says. "What's the problem?"

"We installed a way to block sensory data," he says. "Don't worry, I'm taking it off now."

"Why on earth would you do that? It's really freaking me out."

"It's complicated," he says. He does not want to explain to her.

"Blocking sensory input is dangerous. There's already too much chance of instability."

"You fixed the instability problem," he says. "Right before you left for Miami. And I'm sorry, I didn't mean to load you into the simulator that way."

"Still, I don't see any reason for it."

"It saved lives," he says. "It was necessary."

"What? How?"

He cannot hold back from her any more, so he tells her about her death. He explains how scanning the brain of the man who killed her prevented two more nukes. And he confesses that he loads Al-Razi's brain into the simulator to hear him scream and beg for mercy.

"Tonio, Tonio," she says. He can almost feel her caress his cheek. "I know you're in pain, but what you're doing is wrong."

"He's just a simulation," Antonio says without thinking.

"Just a simulation," she says, "like me."

"I didn't mean that," he says.

"But it's true. Ones and zeros. That's all I am."

"No," he says. "You're more than that."

"If I am more than that, then you have become a monster. I do not want to believe that my Tonio is the kind of man who tortures for pleasure."

Has he become a monster? He doesn't want to believe that. But even Bricker had shown qualms about what they had done to Al-Razi's

simulation, and she had the justification of saving lives.

"Erase our files," she says. "Prove that we were nothing but ones and zeros to you."

"But I miss you," he says.

"And does this simulation really ease your pain? Or merely extend it?"

He cannot reply, because he does not know.

"Please, Tonio. You have to let me go, for

your own sake."

With a few keystrokes, Antonio shuts down the simulator. He selects Shanisha's and Al-Razi's files on the hard drive. With one click he can erase them. But how can he wipe away the last remnant of the woman he loves?

He can imagine her reply: *If you don't, you're wiping away the man I loved.*

So he clicks, and the files are gone. ■

IN TIMES TO COME

It may still be the depths of winter outside, but our next issue embraces its April cover date with stories both serious and light-hearted.

Our lead piece is Bond Elam's "The Eighth Iteration," in which colonists on a forest planet discover a mystery with profoundly unsettling implications.

The fact article, "New Horizons at Pluto," from Richard A. Lovett, looks at the New Horizon probe's impending flyby of the dwarf planet. We'll also have a special feature on writing from Stanley Schmidt, full of valuable advice from a veteran editor on "Hiding the Info-Dump."

Then a ship's crew has an unexpected encounter while hunting comets in Ramona Louise Wheeler's "Dancing in the Dark"; paternity turns out to be a more complicated matter than one would guess in K.J. Zimring's "Partible"; and "The Last Days of Dogger City" by Mjke Wood are full of danger and adventure.

On the lighter side, Barry Malzberg and Bill Pronzini bring us a day in the life of an Immigration officer at a very Golden Age spaceport in "Transfer Point"; Ron Collins shows us that more isn't always better in "Daily Teds"; Guy Stewart nods at pastoral SF in his Probability Zero, "Whey Station," and we get a peek behind the curtain at a seemingly obsolete job that has persisted into a science fictional future, in Adam Troy-Castro's "Down, Please: The Only Recorded Adventure of Ensign Lars Fouton," not to mention all of our excellent regular columns – no foolin'.

See you back here in a month.

All contents subject to change

The Extraordinary Extraterrestrial Togo Mouse from Ghana

Ryan W. Norris

Brett decided he finally had the right place when he wandered into a paper-strewn disaster. For some reason none of the offices or laboratories at Ware University in Accra seemed to be labeled with room numbers, and based on what he could gather from asking directions, the hidden numbering system employed no logic that Brett could comprehend. The many Ghanaian faculty, from whom he had to make inquiries to find this place, had all maintained immaculate offices, albeit often with worn and old equipment. The university's single American faculty member clearly didn't follow suit. The white guy working at his computer was an even bigger clue that Brett was finally where he wanted to be.

Brett knocked on the doorjam.

"Dr. Jordan?" he said.

The man looked up from his screen. He had tousled brown hair, a scraggly beard and was dressed in khaki field pants and an untucked

button up shirt—the informal apparel yet another clue that Brett had found his man.

"Yeah?"

"Hello Dr. Jordan, I'm Brett Henderson."

Dr. Jordan just looked at Brett with a puzzled scowl.

"I'm the reporter with *VirtPress*. We had an appointment."

Dr. Jordan clearly made an attempt to pretend that he did, in fact, remember the appointment.

"Right, right. Call me Alex. Look, do you mind if I finish this up real quick?" he asked while pointing to his monitor. "I just need another minute. If you'd like, you can go check them out. They're right across the hall."

As Brett was leaving, Alex added "It's room 422," as if that last bit of information was going to be helpful.

Stepping outside the office again, Brett was a bit afraid of trying to find anything and didn't trust that he could figure out what

“across the hall” meant in this place, but he was sure that he could at least stand in the hall looking lost when Dr. Jordan—Alex—left his office. Yet by some miracle, the first door he tried led him to a room that bore a similar hallmark of dishevelment, a clear indication of success. Just inside the door was a large aquarium containing several mice. Brett stared at the animals trying to see what was so special about them. They were cute, brown, beady-eyed, and entirely mouse-like. They seemed really small; their ears might have been bigger, and their brown fur was more speckled than he might have expected. Or not. They were just mice. Who actually knows what a regular mouse looks like in the first place?

Alex took less time than Brett expected.

“Sorry about that,” he said.

“No problem. So these are the aliens?”

“What?” Alex scowled as he looked toward the tank Brett was bent over. “No. Those are just ordinary house mice. The *Leimacomys* colony is over here.” He headed to one corner of the room.

Brett followed him to a new set of tanks. These were equipped with heat lamps alongside a row of kids’ ant farms complete with plastic tractors and barns. He wasn’t sure what he had been expecting, but he would have thought the planet’s only known extraterrestrials would warrant something a bit more elaborate. He bent next to one of the glass tanks to get his first real look at an alien. They looked just like the other mice.

“They look just like the other mice.”

Alex gave another puzzled scowl. The creases on his forehead suggested this was a common facial expression for him.

“You think so?” he asked. “They’re actually pretty distinct.”

“Well. They might be a little bit bigger and I guess their tails are shorter.” Brett saw that the scowl was receding, suggesting he was on the right track.

“The tail’s definitely shorter,” he said more firmly this time. “It might be darker brown and I think the ears might be smaller. They don’t move around as much either. I don’t know. The biggest difference seems to be the ant farms and the heat lamps.”

The scowl returned.

“Sorry,” Brett added lamely.

“Huh. Well, they’re pretty distinct. Mammalogists have always had a hard time determining what they’re related to. We always knew they aren’t close relatives of anything else.”

“So you’ve always suspected they might be extraterrestrials?” Brett said pulling out his tablet and starting to jot down what was being said.

Alex grunted a chuckle and shook his head. “No. Definitely not.”

“Sorry. Can we back up? I thought you were the one who discovered the, uh, alien mice.”

“*Leimacomys*,” Alex said, providing a name for the creatures. He leaned over to see that Brett was spelling it properly. “Its common name is the Togo mouse or the groove-toothed forest mouse but people who study mice don’t really use common names. No, I wasn’t the first. It was originally named in the 1890s back when Togo was a German colony. They only caught two animals and then sent them to a museum in Berlin.”

“And they didn’t think it was particularly weird?”

“It got a new genus name, which would have been more remarkable a few decades earlier before guys like Oldfield Thomas arrived on the scene and started realizing just how diverse mice were.”

“Genus, that’s right above species, right?”

“Right. Lions and tigers are different species in the same genus. Housecats are the same family, different genus. To my knowledge, nobody ever tried to combine *Leimacomys* in a genus with anything else. But they also never even tried to put it in a separate family. It bounced around between several families of mice and mice-relatives, and eventually, at the beginning of this century, they were given their own subfamily. That’s a rank between genus and family.”

“And now you think they should be in a new family after all?” Brett asked.

“New family, new order, new class, new phylum, new kingdom, new domain, and whatever we want to erect above that. These aren’t mice, rodents, mammals, or animals. They don’t have even our basic biochemistry. Those house mice at the entrance are more closely related to pine trees, mushrooms, and the bacteria and viruses that make them sick than they are to these ‘mice’ over here.” Alex used the finger quotes. Brett hated the finger

quotes, but he had to admit they were useful sometimes. The finger quotes had kept him from asking at least two more clarifying questions.

Brett bent back over the tank.

"They're just *mice*." Brett didn't use finger quotes.

"Hey, I'm as surprised as you are. Probably more surprised. These guys are a bit weird in a skull character or two, their back molar in particular. But there's *nothing* in their basic physical features that would suggest that they aren't part of the bigger evolutionary radiation of mice and their relatives. They have a couple of physical characteristics that make them hard to place, but they also have scads of characteristics that put them in the broader mouse group. Along with that is everything they need to be called rodents, mammals, animals, *et cetera*. Things start to get weird when you look at the cellular structure, but they get *really* weird when you start analyzing the biochemistry.

"Let me back up a bit. Life as we know it—or I guess I should say life as we *knew* it—has information encoded in the four nucleotides of DNA, deoxyribonucleic acid. Those are adenine, thymine, guanine, and cytosine: A, T, G, and C. That information is transcribed into a messenger RNA, ribonucleic acid. RNA is similar to DNA except that it has a slightly different chemical backbone and uses uracil instead of thymine, which means its nucleotides are A, U, G, and C. In the ribosomes, the cell translates the information in messenger RNA into strings of amino acids that fold up into proteins. That process is helped along by structural RNAs that help make up the ribosomes and that go out and collect the amino acids.

"These so-called 'mice' use glycol nucleic acid, GNA, instead of both DNA and messenger RNA and they have mostly different nucleotides. They use diaminopurine in their GNA, although adenine is still used in their structural RNAs, and they exclusively use thymine like our DNA instead of uracil like our RNA. They also use isoguanine and isocytosine, which are basically flipped versions of our Cs and Gs, and they use a hydroxypyridone that pairs with itself. We've just recently determined that they seem to use that as a start and stop signal. So that's 5 bases, D, T,

iso-G, iso-C, and H—in contrast to our A, T, G, and C. The genetic code that converts nucleotides to proteins is obviously also completely different from anything else on Earth, and they have at least one extra rare amino acid and might be missing several others. And that's just the start of their biochemical weirdness."

He pulled up the cover of one of the tanks and made room for Brett who was still madly writing, hoping his recorder was getting everything that he'd have to look up later. The mice seemed a bit perturbed, which might have barely made them as active as the house mice from before.

"Here. Take a whiff."

Brett was a bit uncertain that he wanted to sniff a tank full of alien rodents, but Alex seemed eager to get a reaction. He leaned over and took a long slow inhalation.

"I know that smell," he thought for a moment. "High school biology. We dissected worms."

"They have trace amounts of formaldehyde in their bloodstream. That would be deadly to any animal on planet Earth, but they seem to need it."

"How come nobody noticed the weird smell before?"

"There were just the two animals caught in 1890. I have no idea whether Büttner, the collector, noticed the smell or if he just dropped them in alcohol, but the specimens have been in alcohol ever since." Alex did his best to pronounce the unlaut U, but proved himself not a German speaker. "The alcohol was changed out regularly enough that the smell would have dissipated pretty quickly and no one in a museum is going to think twice about a formaldehyde smell since so many of the other specimens are preserved in a formaldehyde solution anyway."

"So how do they get the formaldehyde? Do you put it in their water? Could they even get that in nature?"

"Nope. They appear to synthesize it on their own, but they seem to need formic acid to do it and to make their GNA. That's where these ant farms come in. If they don't get a steady supply of ants, they don't survive. That took some experimentation. I tried to rear them on termites in the field, but the one female I had just kept getting sicker."

"Wait, one animal? How did you start a colony with just one animal?"

Alex reacquired his puzzled scowl. "You don't know the story? It was all over the news after our first *Nature* paper. As a science journalist, I'm surprised you don't remember."

"Sorry. We don't really have a science journalist. Nobody has a science journalist anymore except maybe the *New York Times* and public broadcasters. I was in town to cover the G-50 summit and my editor asked me to drop by and try to resurrect the alien mouse story."

Alex was clearly bothered. His face couldn't scowl any further so he added a sigh before launching into his story.

"Before we came along, the only two *Leimacomys* ever caught were from right on the border between Togo and Ghana. Several prior expeditions had gone to the area, but had no luck. I wasn't convinced I was going to do much better, but I was also exploring the possibility that the area was an overlooked biodiversity hotspot. At that time we thought the closest relative of *Leimacomys* had split off from other mice around fifteen or twenty million years ago. That made the region a good candidate for harboring new species, relicts that had held on there just like *Leimacomys* had, even if not for as long. A lot of times those tend to be cryptic, things that look like other existing species and had been overlooked in the past.

"I planned an expedition to the region near Kyabobo Park in eastern Ghana back in 2016. I had a good friend and colleague here at Ware, Paul Appiah. Have you met him?"

Brett shook his head.

"You should. Paul's as big of a player in all of this as I am. He's just down the hall. Paul and I had been talking about getting into the region for a while, but I was a postdoc doing other people's research and then I was a new assistant professor back in the States trying to get a lab started. Anyway, after all that, we managed to pull together enough funding for a small trip to the region. I couldn't go to the precise spot where *Leimacomys* was first discovered since my connection, Paul, was in Ghana and not Togo. But as I said earlier, it was captured right near the border and nature doesn't usually care much about political borders unless they're based on big rivers or mountains.

"It was actually pretty tough going. The local tribes in that hill country tend to keep to themselves and are wary of outsiders, probably because they have a history of getting screwed. We did manage to hire a guide and clear our trapping with the chiefs after some convincing.

"We set up camp and set traps for two nights. I was out checking our pitfalls when Paul came running toward me. Pitfall traps are just buckets buried in the ground with plastic sheeting guiding the mice toward them. I was on the last bucket and it had caught a mouse. My first instinct was that it was a *Leimacomys*, but since coming to *Leimacomys* country, I had already tried calling three or four of the mice we had caught *Leimacomys*. So I'd learned to stop trusting my instincts and stop getting excited because the only thing I was accomplishing was giving Paul a chance to laugh at my expense. So this time I convinced myself that I had a juvenile *Lophuromys*, a brush-furred mouse. They often have broken tails—they lose them as a defense mechanism and they don't grow back. It's a once-in-a-lifetime get out of jail free card and would explain the short tail. It was in the shade of the bucket so I didn't get a good look at the color and the mouse was really fat like a *Lophuromys*. I'll explain why in a minute.

"Paul was now running toward me and shouting something, but I ignored him long enough to grab the mouse and drop it into a live trap with a broken treadle that I was carrying back to camp for repairs. Then the shots came. It wasn't the single 'Boom!' of a hunter's shotgun, but the irregular 'Pop! Pop! Pop! Pop!' you get when people are shooting at other people. Then Paul got close enough that I could see his face and he was scared. Then more shots came and I realized they were between camp and us. Then I got scared and ran away with Paul.

"We saw some of the soldiers and they were white. Then we saw another group of Asians, more whites, and some that might have been Arab too. Nobody shooting looked African and it was clear that all the non-Africans were shooting each other. Somehow in the middle of nowhere a war had sprung out right around us between two foreign armies!"

Alex was shaking his head and gesturing wildly as his voice became ever louder.

"Turns out that the Aboriginal Liberation Front, A.L.F., chose that moment to try their first experiment in redrawing borders. They decided that the local Adele people had been unfairly split into two by colonial boundaries and it was time to give the land around Kyabobo to Togo so they'd all be on the same side of a border. It was part of a bigger plan to redraw the map across the globe. They didn't start with anything dramatic like Kurdistan or Ossetia, because then they'd have to face big armies from big countries. They wanted to start small and show the world how great they were and gain support for bigger enterprises. All they had to do was conquer an ungarded national park and some of the surrounding area and declare victory. But apparently someone had tipped off the UN about ALF's plan."

Alex had started saying "Alf" instead of listing the letters of the acronym. He continued.

"ALF assembled in Togo, and a special ops team from the U.N. Security Council dropped into Ghana, and Paul, me, our mice, and the poor Adele locals were trapped in between."

"Now if I had known who these people were and which side was which, I might have tried to head west and catch an American or British detail. But we didn't have a clue. All we knew was that the locals were probably going to be pissed at anyone not local and the non-locals were all busy shooting each other. So we ran south until we were too tired to run and then we walked. All we had was what we were carrying, which just so happened to include that last mouse. I probably would have even ditched that bag except that it was mostly full of oatmeal, palm nuts, and peanut butter, which we had been using for bait, some water, and a few expensive electronics. I'd left behind enough money in gear back at camp that I didn't feel like tossing my GPS units."

"Eventually I got around to checking the mouse in the trap. Well, Paul did, actually, and it had turned into five mice. She had been pregnant and gave birth to a litter of four, during the jostling around. Then we got a good look at her and realized what we had. Paul got another laugh at my expense, this time for *not* realizing I had caught a *Leimacomys*. That was definitely the only good news we had that day."

"But then we started getting clues that this mouse was something very different. There

was the smell. And she was so hot to the touch that it almost hurt. She had grown weak and we got her some water and food. As I mentioned before, we gave her termites, which she was happy to eat, but continued to get worse until we ran into a patch of driver ants so thick that a lot of them got into the bag and the trap she was in. She perked up after that and even though we hadn't figured out that she actually needed the ants specifically, we at least knew that she liked to eat them and we kept giving her more."

"Eventually we got up the nerve to hitch a ride and then hire a ride and managed to get back to Accra. That was when the real experiments started and when we started realizing just how amazing our find had been."

"And why are you and the mice still here? In Ghana?" Brett asked.

"The Ghanaian government wouldn't let the animals leave the country. I can't blame them; it's been an intellectual and biotech coup for a nation this size. I wasn't going to get tenure at a university in the States if I spent all my time over here. Paul convinced Ware to offer me a position on the faculty, so here I am. The pay's great for Accra, but I still haven't figured out how I'm ever going to be able to retire in the U.S. considering the exchange rate."

Brett motioned at the animals in the tank. "You must have gone back for more if you have all these."

"The region is still a disaster. We've tried getting as close as possible, but have had no luck and others have searched the Togolese side with no luck. I wasn't exactly the only person to go looking for these guys since 1890. Even if we could make it back, there's no telling how long it would take us to capture them again. Nope, what you see here are all descendants of that one pregnant female."

Brett went back to looking at the animals in the tank. As far as he could tell, they were really nothing special.

"No offense, but they are just mice. Sorry. I mean 'mice.'"

Alex scowled, sighed, and shook his head.

"Like I said, they aren't mice at all. You've been calling them aliens because that's how the media portrayed them. Up until a month ago I would have corrected you. Based on what we knew about them at the time there

were other options. For example they might have been relics of RNA-world.”

“Which is?”

“RNA-world is a hypothesis that life’s earliest biochemical evolution involved just RNA which performed the roles of both DNA and proteins. RNA is capable of both storing information like DNA and folding into useful shapes like proteins, although it’s less effective than either. *Leimacomys* uses structural RNAs just like life as we knew it and that might be a relic of a shared ancestor during the RNA stage of life.”

“So what changed?”

“Well, we have some exciting new findings. Our new paper is embargoed so what I’m about to tell you needs to be kept quiet until it’s published. When we went back to the general area we didn’t find any new *Leimacomys*, but we did find some microbes that have the same type of biochemistry. We even have a few more examples from different areas around the globe, but those are a lot less common and there seems to be a lot less diversity outside of the Ghana-Togo region.”

“How is it that no one noticed them before?” Brett asked.

Alex shrugged. “No one knew what to look for. These microbes were rare in the first place and conventional sequencing techniques would just give you a few short strands of As and Ts since the Hs, iso-Gs and iso-Cs don’t bind to our nucleotides. It would just look like you had a bad sample and you’d throw it out. Once people knew what they were looking for, things started to turn up. We heard from a few people around the world that had found these really rare microbes, but basic phylogeographic and population genetic analyses make it pretty clear that everything originates back to the Ghana-Togo border.”

“I don’t get it. Why does that make them aliens?” Brett interrupted.

Alex got animated again. “Because it indicates one point of origin that’s recent in geologic time! If they had been here all along, then they’d be dispersed across the planet and the signal of where they started would be long gone. And it can’t be a separate recent origin of life because you just can’t evolve something as complex as a mouse in that short of a time-frame. Nope. The extraterrestrials are here and as silly as it sounds, they’re like Mr. Spock

after all. They look like normal earthlings except they have pointy ears or strange molars, but cut them open and they bleed green or, in this case, smell like formaldehyde. But do a real evaluation of them and they’re nothing like us. We know that life on this planet has produced an unbelievable amount of convergent evolution. That’s when similar body types evolve in completely unrelated animals. Tasmanian wolves, which are extinct marsupials looked like they should belong to the dog family, but were more closely related to kangaroos and koalas. True moles, marsupial moles, and golden moles all look alike but are part of totally different groups. Things that look like cactuses evolved independently in the Americas and Africa. But this! This amount of convergence is incredible!”

Brett jotted notes frantically. He took some pictures, verified that Alex would be glad to follow up with further emails, and a promise that Brett would be the first to know when the embargo was lifted. Alex seemed happy to talk to an American journalist in person rather than on webcam. Brett eventually thanked him and said goodbye. If he could only write an article that could convince the readers that we didn’t already know the alien mice were aliens, but now we do, then he was sure it would be a bigger story than any of his G-50 summit reports. Too bad the pictures he had to go with it were just “mice.”

11,800 years earlier

“Sir, do you have a moment?” Just as the words left his mouth, Sseekt realized that his friend and superior officer was busy delivering a tongue-lashing over the coms.

“I don’t care!” Hacht shouted into the microphone. “No more excuses. Get this infestation taken care of.” He paused to hear the other side of the conversation, which was clearly not to his satisfaction. Even though the discussion was audio only, Hacht’s auxiliary arms reflexively flashed an angry intimidating yellow.

“If we can’t get the food storage under control, the mission’s over and we head for home. Right now you’re the most important team on the ship. Eradicate the vermin. End of story. Good-bye.”

Sseekt had timed this conversation when he thought Hacht would be relaxed and in a good

mood. Instead he was loudly grinding his incisors together in frustration.

"What do you want?" Hacht snapped.

Sseekt couldn't back down now.

"It's about the next survey mission," he said.

"You mean Kranfski's mission? What about it?"

"I was wondering if you might consider making it *my* mission."

Hacht turned to face Sseekt.

"Why would I want to do that?"

The plan was to recite a long series of credentials and arguments, but Sseekt was realizing that Hacht was going to see right through all of it. The two had known each other since their days in training. Sseekt let his lips drop over his teeth and both pairs of arms hang limply, a sign of lowered defenses and honesty.

"It's Rissoe," he said. "She has an egg ready and if I don't move fast she's going to reabsorb it just like last time."

Hacht's colors cooled in sympathy. After all, the two *were* old friends.

"I really shouldn't . . ."

"You don't understand," Sseekt protested. "You already have an egg."

Hacht unconsciously rubbed his own midsection, feeling the egg in his pouch. It would hatch soon, and then he'd feel his child moving around in there, growing and absorbing the liquid nourishment his body provided.

Sseekt continued, "She won't mate here. The ship depresses her. She needs air above her head and soil beneath her feet."

"Kranfski isn't going to be happy."

"Kranfski has two offspring already. He's been offship recently and Rissoe and I are perfectly qualified to update the survey of this planet."

"It's inhabited, you know."

"Haired bipeds with a rudimentary civilization, tool use, and small family groups. But they had no agriculture or cities on the last pass. We'll be careful to avoid them."

Though still reluctant, Hacht seemed satisfied. "I suppose we *could* use another pair of trained surveyors. Do a decent job and I might add the two of you to the regular rotation. By the way, you owe me a big favor after this."

"A *huge* favor. Don't worry; we'll do the job right. I won't let you down."

* * *

"I want a beautiful beach right at sunrise!"

Rissoe said as she absentmindedly sniffed one of the many decorative fungi that lined the shuttle. Sseekt had paid a small fortune for these adornments, but he had to admit they stayed fresh, emitting their pleasant odor throughout the pair's two-week travel time in system.

"This one's my favorite," she said softly.

"The stripes are just gorgeous. I can't believe you could find it on ship." All Sseekt could see was a drab green disc. The shopkeeper had been adamant that it was simply incredible in the infra-yellow spectrum: colors that only females could see. Apparently, she'd been correct.

Things were going perfectly. Sseekt's auxiliary hands stroked his torso where his pouch was located. It wouldn't be long now.

"Look, we're finally getting a good view of the planet," he said.

The blue marble was becoming visible as they passed from the dark side of the planet. It started as a sliver and shifted to a crescent. It was gorgeous, colored as it was in blue, green, brown . . . and white.

"Is that ice?" Rissoe asked.

"There's some ice at the poles, but it's mostly a cool but very habitable world."

"That's a lot of ice."

"Clouds," Sseekt muttered, "it has to be clouds." He started to look at the readouts coming in.

"Clouds don't have outlines that match continents."

"Okay," he admitted, "it's ice. But all we need is a nice equatorial coastline, right?"

"At sunrise," she added.

"Sunrise," he agreed.

Rissoe was the first to look into how the intelligent species had progressed.

"They have agriculture and are clumping together in towns," she said. Her coloring was warming up, but not with passion.

"No way! There was no sign of anything like that on the last visit."

"It's unambiguous. We'll have to switch to Protocol 4."

Protocol 4 was going to severely limit where they could land and how long they could stay. Sseekt scanned the available options. There weren't many.

"Okay, no beaches, but how about mountains? Here's a patch of low mountains, in the tropics that's far enough from any intelligent lifeforms and hidden from prying eyes by dense forest."

Risroe's colors began to cool. "That sounds wonderful." She was clearly trying to stay optimistic.

They set down just before dawn and released the probes to gather their information. Sseekt carefully laid out a comfortable padded cloth and brought out the meal he had specially prepared for the occasion. Food always makes for a nice prelude to mating.

"It's really cold here," Risroe complained, but Sseekt moved closer, and her mood seemed to hold.

Dawn arrived gently, though it filtered through the forest without the stunning beauty that it would've had on the beach. Sseekt took the opportunity of the growing light to begin to spread the webbing on his auxiliary arms, the chromatophores causing them to acquire a brilliant metallic ultraviolet hue. Risroe still shivered, but she started to stare, her eyes mesmerized by the patterns. It was a great start. Sseekt soon began fluttering the crests on the side of his head, displaying the same color pattern. Risroe's eyes shifted back and forth between his head crests and auxiliary arms.

Then the raindrops started to fall. At first they both tried to ignore it, but rain came as pure water on this planet. Instead of adding solutes like formaldehyde and their other waste chemicals to the water, the trees above them just let the water roll off their leaves unaltered. The pure water wasn't quite painful, just uncomfortable. He could see how Risroe's skin was becoming slightly swollen and wrinkled and her colors muted. His own display was losing its luster.

So he turned it up a notch; he started dancing. What he lost in color he made up for in

movement. Risroe's eyes went from arms to head and back again. She might have been soggy and uncomfortable, but she was still getting into the mood.

Just as Sseekt felt sperm flood into his pouch, Risroe's eyes drifted to that part of his torso. His hormones must have been doing the job. Males couldn't see it, but, at this point in the mating cycle, the skin above their pouches turned a brilliant infra-yellow, and Sseekt must have reached that stage. Risroe was presumably focused on a bullseye pattern on his chest that would lead her to the thin patch of skin where she would soon pierce him with her ovipositor and lay the precious egg. It was supposed to be painless thanks to the hormones coursing through his bloodstream, but the thought made Sseekt as nervous as he was thrilled. It was coming any moment now: the whole point of their excursion.

But something was wrong. Sseekt realized that Risroe was no longer looking at him; she was looking *past* him. Her gaze shifted from a lovestruck stare to a look of confusion and then disgust. Her color changed from the yellow stripes of passion to the dull green of frustration.

"That's . . . that's just revolting!" she cried as she pointed past him. Risroe stood, stormed past a dazed Sseekt, and started to hurriedly prepare the shuttle and probes for departure.

Still confused and a bit drunk on the emotions from a moment before, Sseekt looked behind him. Peering out of the food containers on the cloth were several pairs of beady eyes belonging to a handful of stowaways from the ship.

Sseekt angrily kicked over the food containers.

"Shoo!" he said, causing the mice to abandon their meal and scatter into the forest's undergrowth. ■



Illustrated by Josh Meehan

Karma Among the Cloud Kings

Brian Trent

I.
Fifty thousand feet above Tempest's highest clouds, Antarag Vel-Heth invites me to sit beside him in the lobby of Lindorm Refueling Station. It's a desolate, littered expanse of tables, party-streamers, and plastic people with unceasingly flapping jaws.

"What . . . what are they doing?" I whisper, sweating despite the room's merciless air conditioner.

"Eating," Antarag winks. "Talking." His pitted skin stretches like a weather-beaten tarp across a knobby skeleton and skull of aquiline protrusions.

The plastic people have no food that I can see. One of them leaps up from its chair, arms raised in silent declaration while the others applaud with rubbery hands. Discolored mouths swing open and shut on cheap hinges.

Antarag grins at me with pained, frank interest—I wonder when the last time he's had a real, flesh-and-blood female visitor up here with him. He knows I'm from Bellcap 51. He knows we're all Jains there, with our shaved heads, monastic robes, and vows of celibacy. Still, my eyes dart nervously to his holstered pistol.

I ask, "What are they eating?"

He taps his forearm gauntlet. Menu options unfurl in neon petals. "That one's eating steak and potato pancakes," he says, pointing to one guest whose plastic body appears to have been assembled Frankenstein-style from at least six different modular components. "Those two girls are eating sushi—" he motions to a pair of androgynous mannequins who are miming the use of chopsticks, bringing invisible morsels to their skeleton jaws. "We've got blihabhi caviar, fresh raspberries, Osirian felsacs, comet cakes, beef stroganoff, flame-roasted marrow. Name it, I've got it. Ten million foods from across the galaxy."

Antarag has lent me a spare visor; I fit it over my eyes and ears. The plastic people disappear, and I now see them as they see each other: a revelry of beautiful men and women. The men are square-jawed and chiseled. The women are elegant and buxom; my eyes stray to the jewelry sparkling at their throats and fingers. Thudding music weaves among the sudden babble of voices.

"A pretty girl like you, Preema, should have jewelry like that," Antarag says, following my stare. He has changed, too: the sickly-looking ladder controlman is now a muscular brute in a diamond-studded suit. No longer balding, his scalp has grown a lustrous mane like a cobra's hood.

I lift the visor; the beautiful people vanish back into plastic monstrosities. One falls out of its chair, and the others erupt into silent apoplexies of laughter, clutching their plastic bellies, tilting their heads back like a nightmare of howling skeletons.

"We do not wear jewelry," I say, feeling dampness hatch across my shaved scalp.

"And you don't eat meat, right?" he presses me, rotating his chair, legs splayed in a crude invite.

"We do not eat meat. We do not eat physical food at all."

He nods, eyes prowling over my shapeless robe as if he can see straight to my lean, brown, twenty-two-year-old body. "No food, huh? So where do you get your sustenance from?"

"The sun."

"Photosynthesis? Shouldn't your skin be green, then?"

I make the green receptors flush into visibility on my face and hands. Each one displays itself in radiant Sanskrit. Each curve and loop signifies a Jain value: Peace. Nonviolence. Knowledge. Truth.

His grin widens a millimeter. "Do those things appear *all* over your body, Preema?"

Ignoring this unwelcome lechery, I say, "Their real bodies are in orbit, waiting for their ships to refuel. Would they not prefer real food, then?"

"Illusion is more satisfying, girl."

"But even if it *looks* like real food, how do you convince them that it has taste and substance?"

Antarag draws his arm around my shoulders, wires dangling like weeds off his neurocast suit. "Most of it is just vibration," he says proudly. "The neurocast suit vibrates at key frequencies along the jawline. It creates whatever parameters of resistance a meal should have. The shrimp is crisp, the steak rare, the felsac pops between your teeth."

"But the *taste* of the food . . ."

"Are you craving something? You are, aren't you?" His fingers tickle the gauntlet holodisplay. "How about glass noodles? That's an ancient Buddhist delight, you know."

"We are Jains, not Buddhists."

"You're a flesh-and-blood woman with a real body beneath that robe," he counters. "Put on one of these suits and you can try anything you like—any sensory delight—without breaking your damn vows. And not just food." Antarag points to a dusty sofa, where two grinning mannequins thrust and grind against each other, a mirthless war of attrition that has produced the stress fractures I've observed on many-a-pelvis here. "I don't understand how you all hang out in Bellcap 51,

guys and gals together, and no one *does* anything."

"It is one of our oaths," I explain, and drinking in the view of the nightmarish party, think: does this man have *any* oaths whatsoever? What are *his* values?

A third voice intrudes into our conversation—I'd almost forgotten that Indrani had accompanied me up the space elevator. She is Bellcap 51's matronly, middle-aged supervisor and my direct commanding officer.

"Antarag?" Indrani asks. "If Preema were to wear your visor, would she look like you to the guests?"

The Ladder Controlman barely acknowledges the older woman's presence; his eyes are locked on me. "Yes. Everyone here can be anything they want, even me."

Indrani's eyes shimmer purposefully in her aged face. "Borrowing someone's karma. Interesting. Don't you agree, Preema?"

Antarag rubs his chin thoughtfully. "As I recall, one of your sacred oaths is to always tell the truth."

"To never tell a lie," I correct him, motioning for his visor. "May I?"

He absently hands me his visor. "I'd like to ask you something, Preema. And I expect you to tell me the truth."

The tone in his voice tells me something's wrong. I stiffen, realizing too late that he's known all along, that he's been playing us, drawing us into a comfortable web. I lick my dry lips and say, as calmly as my galloping heart will allow, "Yes?"

He raises an eyebrow and his pitted skin flushes to a deep scarlet; it's like looking at raw meat. "*Why* did you come up here today, Preema? What's the *real* reason you people stopped by for a visit?"

And just then, the security alarm goes off.

II.

We had fled a paradise planet to come to Tempest.

Two years ago I was a twenty-year-old girl tending the gardens of a Jain village on Midsummer's Dream. Now I toiled in a hydrogen-collecting station among the clouds of a bitter, lonely world. Tempest is Shakespeare System's only gas giant. It supplies planets, moons, and space stations with fuel. Its clouds are dotted with atmospheric processing stations—the Bellcaps—

tethered like flowers along the metal vines that trail off Lindorm Refueling Station, fifty thousand feet above us.

My job on Midsummer's Dream: grow vegetables.

My job on Tempest: climb into a tight-fitting biosuit and walk vertically along the Bellcap spires to keep them clean of debris. Tempest's atmosphere is littered with scraps of bygone processor stations, built in haste by colonists who didn't appreciate what relentless winds could do to man's handiwork. Each spire is a three kilometer-long lance through Tempest's cobalt-hued clouds. Each collects planetary hydrogen day and night, pumping the gas straight up to Lindorm Refueling Station where ships from across the solar system come to refuel. A gas pump for spacefaring society.

Walking the spires, cleaning them of the constant debris flurries, is dangerous work.

It would be easier to take the lift.

"And this is why we never take the lift," Komal explained over my headset, the day before I met Antarag Vel-Heth and his party of plastic people.

I looked to his boots, gaping at the easy way he was balanced on only one foot, the other paused mid-stride just inches from a slug clinging to the spire like an oversized raspberry. It's one thing to know that our magfiber boots form a molecular bond with the spire. It's quite another to be *this* sure-footed while walking it. Glowing debris whipped through the air like confetti, bursting as they touched the electrified bristles that lined the spire like thorns on a rose stem.

"Think of all the slugs crushed by the lift before we arrived," Komal explained, his bearded mouth frowning behind his faceplate. He bent to cradle the specimen in his hands. It flattened its rubbery body in fear, and Komal petted its striated flank reassuringly, saying, "Thousands, maybe millions, of undocumented murders. They are safe now that we are here."

No harm to any living thing; that was the Jain oath of Ahimsa.

"I forgive all living beings," whispered Komal, uttering our sacred prayer, "and may all living beings forgive me. All living beings are my friends. I have malice toward none. I—"

BOOM!

The shockwave twisted me, and for an instant, I thought my boots had lost contact with

the spire. I screamed and fell forward on the vertical spire, striking my hands out at the last second so my gloves, arms, and knees would bond with the nanosteel. My stomach almost emptied the water I had swallowed an hour ago. In that moment, I imagined the report that would reach my old friends on Midsummer's Dream: *Preema Goswami, 22, fell thousands of feet to her death. Tempest's Jains made her walk outside in a storm out of fear for stepping on a slug...*

Komal finally tossed the specimen into the wind. It snapped open its frills and, like an umbrella, caught an updraft to vanish into the debris-strewn clouds. Only then did he turn his sensitive eyes on me; his was a worn, deeply lined countenance set in that bushy beard. "Are you all right, Preema?"

I harnessed my anger. "Yes, Komal. Nice of you to notice that I almost—"

BOOM!

As I lay glued to the nanosteel, I turned my head south. An immense debris strand had become coiled around the end of the spire. Blind luck, really, that it had missed the electrified bristles. It made me think of the ancient custom of tying a string around one's finger to never forget. Its two ends undulated like a pair of waving arms, unfolding and twisting in mindless, wind-driven merriment.

I rose carefully to my feet. The fiery ribbon danced, its arms snapping in bullwhip-like gyrations with enough kinetic energy to—

BOOM!

"It looks alive, doesn't it?" Komal asked behind me.

"A little," I admitted, steadying my feet. The ribbon's contortions suggested the *jiva* of life. But I knew—everyone knew—that Tempest's pollution was *ajiva*: nonliving, artificial matter. The only living creatures on Tempest were slugs, and they were immune to the electrified bristles, so no harm was being perpetrated.

Malice toward none.

Across three kilometers, Supervising Officer Indrani spoke through my helmet radio: "Preema? Ladar is showing a large piece of debris stuck on the spire."

"I am looking right at it," I replied. "I shall remove it."

"Good." A hesitation. "Are you okay, Preema? We heard you cry out..."

"I almost fell."

A very long pause. Finally, Indrani found her voice and said, "It wasn't your karma to fall. But please be careful. Ladar measures this scrap at six meters. That could whip you off the spire if you're reckless."

I unclipped the extendable clawhand from my tool belt and advanced on the dancing red strand. "I am never reckless, Indrani. Proceeding now to remove the—"

A second piece of debris smashed into me from behind, snagged around my waist, and tore me off the spire into the endless blue.

Komal was sixty years old and he rarely did anything to challenge that fact, but as I tumbled off the spire into the clouds he must have found a reserve of youthful reflex. His hand clamped around my ankle. I screamed again, dangling like a caught fish. The clawhand dropped, bounced off the spire, and spun into the cobalt troposphere below me.

Komal struggled to lower me to the spire; my suit's magfibers latched on and secured me once more. Heart pounding, I stared at what had struck me: another long strand of debris, this one a brilliant sapphire blue. It seemed to hover in the storm, weaving in and out of the wind like a stubborn eel fighting an ocean's undertow.

"Komal!" I shouted. "Are you seeing this?"

At that moment, the scarlet ribbon unraveled from its perch. Despite the way it had been knotted, it untangled itself and flew *down* toward the blue one.

"Jival" cried Komal.

The strands intertwined. Red, blue, melted into one another to achieve a fierce, throbbing violet. They braided, like two phosphorescent serpents wrapping around each other. The bonding shivered in the wind, undulating to keep position, to avoid being driven off into the gulf of sky.

And then, before our astonished eyes, the double-strand began to climb through the storm. It threaded in and out of the wind, and once more adopted its knotted perch at the spire's end. It wrapped itself securely around the spire like a sentient ribbon preparing itself into a bow.

"Jiva," I whispered in agreement.

The debris was alive.

III.

"What happened out there?" Indrani demanded, once we had returned to the Bellcap. She folded her arms like a scornful schoolteacher, her brown face drawn in sharp lines and plateaus, black hair buzzed into a fuzzy stubble like little magfibers of their own. The entire Jain occupancy of Bellcap 51 sported the same haircut. Genderless solidarity through depilation.

We were still stripping off our biosuits, and it was bad form for Indrani to intrude in our half-naked state, especially with Komal there. It wasn't the antiquated Jain prohibition about men and women seeing each other naked that bothered me, but the urgency in her voice, which suggested high emotion, which upset tranquility, which violated Aparigraha, the oath of detachment from physical concerns.

Which reminded me of my own terror out there on the spire. I could still taste the bitter tang of adrenaline in the back of my throat.

Rather than cover up his partial nudity, though, Komal dressed without haste. True Aparigraha was not to hide from anything; Buddhists were fond of the parable in which two monks encounter the name of Buddha scrawled in the dirt, and while one tries to avoid stepping on his name, the other trudges right over it, footprint marring the word as he goes. Why? Because attachment to a word is still attachment.

"The two strands combined," I said, donning my standard white monastic garment.

"You were reckless," Indrani declared. "You weren't watching your surroundings."

"I *was* watching," I insisted.

"You could have died, Preema."

"Then I guess that would have been my karma," I snapped.

Indrani's scowl deepened until her face looked like an iron mask bolted over high pressure. "You didn't complete your mission. You left two large pieces of debris out there on the spire. They might clog the filter."

"They are not debris," I countered. "They are *jiva*."

My superior officer sighed. "The debris are polyresin fragments left over from the last generation of processing stations." She was practically quoting verbatim from Lindorm's technical manual; she was also upset, I could tell,

because she became more animated and careless in her choice of words when gripped by high emotion. "If unattended, they'll clog up the filters. Our job is to keep the spires running efficiently." Indrani turned her displeasure on Komal. "Preema is not alone in failing her duties. You too turned your back on those strands. Why?"

Our bearded companion offered no reaction to her question. Without his suit helmet, Komal looked like a figure of sandstone, his messy tangle of gray beard burying the lower half of his face. Jains do not lie. Lying is a terrible crime, attracting negative karma around the soul. But neither are we compelled to incriminate ourselves. Silence has many uses.

Indrani seemed to glide over to the intercom. "Geeta, Parul, suit up and proceed to the airlock."

"Those strands are alive," Komal said finally. "They are not mere pollution. We have been lied to."

Indrani released the intercom button and shook her head. "They are pieces of string in the wind. They are scraps of older stations, built in haste by colonists who didn't appreciate how strong Tempest's storms could be. Everyone knows that."

"The two strands willfully went after each other."

"Coincidence. The wind drove them together."

"They combined for a purpose," he insisted.

"Your belly lint also combines. Does that have *jiva*, too?"

Komal regarded her stolidly. "Belly lint contains bacteria. So yes, *jiva* is present and you should know better."

One of the walls slid open, and Geeta and Parul entered the chamber. Geeta was as old as Komal; I remembered that on Midsummer's Dream, they had been married before our small community decided on total commitment to Jain vows. I remembered them walking together, *hand-in-hand*, in the grassy, sunlit fields of that vibrant world. Now they stood beside each other without emotion, a pair of mahogany chess pieces which, as the universe often forgets, was an Indian invention.

Parul was the only non-Indian among us; a blue-skinned Jain immigrant from the nearby world of Winter's Tale, a mean distance of just seven hundred million miles away.

"Be at peace," Parul said, sensing the tension. "What has happened?"

"Komal and Preema disobeyed an order," Indrani explained. She touched the wall, and it dissolved into a viewscreen. The spire appeared, coiled by the purple twine whipping and snapping in the storm.

"Proceed with the removal," she said. They suited up and went through the airlock, clawhands jingling at their belts.

Indrani began to climb up into the dining module. "Komal, I want you on ladar duty. Preema, follow me."

I complied.

It was time to eat sunlight.

IV.

I recalled the nastiness, the hypocrisy, of trying to reconcile the Jain principle of Ahimsa—doing no harm to any living thing—with the biological necessity of consuming physical food. To clamp one's teeth down on a living creature, tearing and chewing, swallowing it in a froth of saliva. To drop a once-living thing into that acid-pit of the stomach. To feel the extra, foreign weight inside my belly, a bitter mockery of growing a child in the womb. To willfully steal *jiva* and, in doing so, drive oneself further from salvation with each bite.

I remembered the Great Hunts on Midsummer's Dream. The orgiastic revelry of an entire village melting into savagery. *The Jain children with meat stuck in their teeth!*

It was the reason we had fled Midsummer's Dream. Midsummerans were a throwback culture eschewing most modern technologies; they lived in simple farming villages. We had believed it to be a good place for us, to form our own community away from persecution.

We had been wrong.

Midsummer's Dream was a throwback world, yes, but to rampant bacchanalias, bloody hunts, and primitivism. At first they were welcoming to us. Slowly, the cruel whispers began. The pranks and abuses. The slain animals left on our doorstep or strung up in my garden.

But it was the Great Hunt that proved the final straw. A gruesome twice-per-year holiday in which Midsummerans gathered in the woods and hills, with their musical instruments and most depraved appetites. They would light huge bonfires. They would round up animals

of all breeds, whipping them into a desperate stampede, and drive them through a gauntlet of human bodies while stabbing, tearing, biting, and devouring them.

As Jains, we did not participate in the horror. Two years ago, our doors shut against one of these grim bacchanalias, we awoke to discover that four of our youngest children had done what children do best: snuck out of their homes in quiet conspiracy to spy the secret rituals from a hilltop.

Except they hadn't stayed on the hilltop.

Maybe it had been the music which lured them down to the festivities. Maybe a dare to get closer, and closer. Maybe something worse, a primeval impulse incited by the drums and chants and smell of blood in the air.

I had been the one to find them the next morning, with meat in their teeth and blood on their hands. Visceral trophies hanging around their necks, animal eyes and teeth and paws strung through with tendons like garlands from hell.

After that night of horror, we had fled Midsummer's Dream. We had retreated to the orbital Jain Temple clinic where we submitted to the bioengineering necessary to make us *complete* Jains. The final physical step to true commitment.

We became autotrophs.

In the dining module atop the Bellcap, Indrani and I climbed into a pair of glowing coffers to absorb a raw solar meal. The blue light of Shakespeare, largest star for two hundred light years, bathed a system of seven planets in a wash of energy that provided our daily nutrients. The light came around us like hot wax as I waited for Indrani's scathing review of my spire-walk.

Less than a minute into feeding, she provided it.

"You failed out there today," she said, eyes closed as she soaked the energy. Her chloroplasts flushed green across her face, hands, and neck, displaying Jain values.

"You were not there, Indrani. And Komal agreed with me."

"Komal is not the commanding officer of Bellcap 51. If we fail our duty here, we shall be homeless once more. What world will take us next? What world is so ideally suited to the cleansing of karma?"

"I am sorry," I grunted.

"You disobeyed my orders. If that debris interrupts the hydrogen harvest, Lindorm will want to know why. If they ask, I will have to tell them the truth."

I must have made my resentment audible, because Indrani's eyes snapped open to regard me with studious disapproval.

"I will have to," she repeated. "As Jains we have sworn an oath to never tell a lie. We do not break our oaths."

"Even if it means that I alone would be expelled?" I demanded, searching her face for any sign of the woman I had known on Midsummer for the first twenty years of my life. The blue light gave her a truly androgynous appearance, scorching away any feminine aspects. A brief memory arose—Indrani and I crawling through the grass to approach a jade butterfly. I remembered her smile, then. Remembered how she would tuck me in each night with a hug and kiss.

The intercom rang a single, chime-like note.

"What is it, Komal?" Indrani asked. "Have Geeta and Parul completed the mission?"

"Call up the external view of Spire 4," he said.

Indrani touched the wall. We were suddenly looking out on Geeta and Parul. They were sitting vertically on the spire, a startling picture of two beings on the edge of karmic oblivion.

A huge purple flower had blossomed at the termination point. It had grown out of the double-strand and was unfurling ghostly, semi-transparent petals even as we watched.

"*Jiva*," Komal insisted.

From the screen, our coworkers chanted in unison, "*Jiva. It is jiva!*"

Within the blossoming creature, new structures were forming before our eyes. I gasped as the quivering petals began to split and sprout, bizarre cilia-like tendrils shivering into existence from the flower's edges. The cilia grew before our eyes and began to whip into the wind, as if trying to produce sonic booms, but lacking the length—at least for now—to succeed. I thought: It's trying to communicate!

I turned to Indrani in triumph. "The debris *is* alive!"

"But we were told—"

"A lie," I interrupted.

Indrani pulled herself out of the coffer and dropped to her knees before the screen. Her eyes were wet.

V.

The ride up the ladder took eight hours, during which Tempest's atmosphere made a full super-rotation of the planet. Komal, Indrani, and I rode the elevator together; the rest of our group stayed behind to study the flower. Geeta supplied us regular updates by radio, and by the sixth hour she had a significant update indeed: a third fragment of debris, also blue, had tried to join the purple flower, but it brushed against the spire bristles and was fried. It now hung like a burnt prayer-flag. A dead thing flapping in the wind.

"Deactivate the bristles," Indrani ordered, and she fixed us with a solemn, quietly suffering expression. "What *are* they?"

Komal sat lotus-style in the lift's corner, gazing thoughtfully at the on-wall image of the exotic organism. "A life form," he said flatly.

I added, "The gametes of a developing organism, maybe. Reproduction through broadcast fission."

Over the radio, Geeta added, "And it is still developing. We can see what looks like the start of a neocortical column. And a rim of parallel structures are reacting to the sunlight as the clouds pass by. I believe they are clusters of photoreceptor cells."

"Eyes?" Indrani asked helplessly.

"Primitive eyes, yes."

"It is clearly waiting for more debris," I insisted. "It is even calling to the other pieces." And I told her about the sonic booms.

My superior officer settled into a pained, contemplative meditation, while I allowed myself a tiny pleasure: my newfound sense of purpose. When had I ever been a decider in my life?

I continued, "The debris coalesces into a gestalt organism. Instead of needing a sperm and egg, it develops out of this fragmentary material. This material that we have been systematically destroying and disposing of."

And I thought: What are the parents? Was there some bizarre garden of alien flowers down on the Tempestan surface, thrusting stamens out into the wind to shake loose this bioluminescent pollen? But that was impossible: planetary radar, ultrasonics, and Doppler would have pinged back something that large.

I turned to Komal. "You suspected this all along."

He gave me an inscrutable look from the floor. "I've been thinking about it since we arrived two years ago. I didn't believe the polyresin explanation."

Indrani was breathing heavily; panic squirmed in her neck. "We've broken the first vow, the law of Ahimsa."

"We did not know," I protested.

But she only repeated in her crystalline voice, "Ignorance does not excuse the damage we have done. We went from one Great Hunt to another."

I thought of the Jain holy words: *I forgive all living beings. May all living beings forgive us. All living beings are our friends. We have malice toward none.*

For *two years* we had been collecting and destroying the debris in Tempest's atmosphere. For thirty years before that, others had done the same. We had been interfering with the life cycle of an indigenous species!

"Something on Tempest is trying to breed," I repeated. "And someone wants to prevent that from happening. Why?"

Komal shook his head. "I think they are already extinct. The debris are all that remain of them, like the pollen of a long-deceased flower. Whatever produced them is dead."

"And *that* is why we must confront our employers," I declared, snapping open the elevator shutter. The skies outside were black; we were seventy miles up now, in the highest reaches of Tempest's atmosphere. My bones felt as light as young bamboo.

"We shall find out what's been happening here," I said. "We will put a stop to it once and for . . ."

I caught my fellow Jains' expressions in the glass.

"What?" I asked, confused.

"Preema, how will confronting our employers help?" Indrani asked.

And Komal added, "Exactly. What do you think this confrontation will accomplish?"

I stared disbelievingly at them. "It will stop this cycle of evil!"

But he only said, "Great secrets have been covered by great expense and effort. Only great power can change that, and what power do we have?"

"We have—"

"We abandoned the horror of power when we left Midsummer."

"Then why the *hell* are we climbing the ladder?" I demanded.

He winced at my vulgarity. "It was your suggestion."

And Indrani added, "You were bent on riding the ladder, Preema. We did not want you doing it alone."

"I suggested it because we need to *do* something. Bellcap 51 is one of *eighty different processing stations*. We need to go to the source!" I hesitated. "If you disagreed with this course of action, why let me go at all?"

"Let you go?" Komal frowned, and he and Indrani exchanged a look. "How would we stop you? All living things must go their own way. You decided on this course of action."

I shouted, "But I am only a kid!"

"You are an adult," Indrani chastised. "We attempted to convince you that this was the wrong course of action. I explained that you'd be disobeying another order of mine. You disagreed with our reasoning."

"Your reasons," I countered hotly, "were for us to do *nothing*! You did not even think to deactivate the bristles until that third ribbon was murdered! You have not decided anything!"

"We decided to watch the flower grow," she said. "See what it becomes to—"

"*Watch the flower grow?!*" My outrage boiled up and over the rigid walls of my Jain training, and now that it was out, uncaged and unchained, I clearly understood why the rest of the Universe laughed at us. Why we were so readily the butt of jokes. How ineffectual we were even in the face of genocide! I even understood the perverse pleasure the Midsummerans must have enjoyed, seeing our youngest members falling straight down the evolutionary ladder with them into the barbarism they argued was the natural state of mankind. After all, wasn't it barbarism—and audacity—that had propelled humanity to the stars? What audacity had we ever shown? We hadn't fought for the living creatures of Midsummer's Dream; we had abandoned them, their planet, and fled into the clouds.

Indrani regarded me with piteous, tortured eyes. "The ladder controlman is named Antarag Vel-Heth. He is the one you will be dealing with."

My stomach sank. "Who *I* will be dealing with?"

"This is your decision." Indrani hesitated. "Perhaps it is your karma to do this, Preema."

"How do we distinguish karma from pure foolishness?"

"Following one's karma opens the right path."

"What do I say to him?"

"What do you want of him?"

"To stop killing the debris! To find out why this policy of murder was first enacted!"

"Then it seems," Komal said, rising, "That you *do* know what to say. Follow your karma, honor your oaths. It is all we have left, Preema."

The elevator car closed in on Lindorm Refueling Station.

VI.

Ladder Controlman Antarg Vel-Heth did not greet us at the airlock. He did not greet us in the hallway leading to the controller room. It was only when we entered the heart of his domain that he swiveled around in his chair to offer a brisk, welcoming salute

He was surrounded by a macabre dance of plastic people.

Ships refueling in Tempest orbit perch carefully above the station to receive their hydrogen. That period of refueling takes time. You don't cross hundreds of millions of miles for a quick drink at the watering hole; you fill your tanks to bursting. Tempest has multiple ships in orbit at any time, guzzling away from the ladder's trans-atmospheric tethers. This means that the crews have time to kill. Time to socialize. To meet and greet the visitors from other worlds.

The thing about Tempest, however, is that it's dangerous to take a shuttle down to the ladder's Control Station for a multiworld shindig. The gravity-well itself would burn up a lot of fuel, but that's the least concern. There are storms here that are older than human civilization. Storms which, back when humankind was first learning to press wisdom into clay tablets on the birthworld, were already fomenting here on Tempest, gathering moisture and energy, churning in maelstroms now amber with the wrath of millennia. We had names for these storms; they were Tempest's curious celebrities, and to enter the planet's atmosphere was like feeding oneself to terrible alien gods.

The safer route was to neurocast into remote-controlled, fake bodies to pass the long hours.

Antarg rushed over to us, wires dangling from his head. He vigorously shook our hands in turn. "What occasion is this? Bellcap 51 honors me with a visit! Come in! The never-ending party's in full swing!"

Indrani and Komal bowed but made no effort to accept his invitation.

We had met Antarg two years ago, upon our immigration from *Midsummer's Dream* to accept jobs manning Bellcap 51. He'd seemed a sweaty, ragged shell of a man then. The phrase "strung-out" had occurred to me, and now I saw this was truer than I'd realized. He was an emaciated thing. Unhealthy and unshaven, unshowered and unkempt.

It was difficult to concentrate on him, however, with the nightmare party of plastic people behind him.

Antarg saw my fascination. "Preema, was it? Here, try this!" He handed me a weighty visor. "This will let you see and hear what they do." He noticed Indrani and Komal's reluctance to get too close. Strangely, this seemed to amuse rather than offend him. "You guys don't mind if Preema has a look, do you?"

"We each make our own decisions," Indrani stated evenly.

The mannequins were terrible creations; they reminded me of holographic cutaways I'd seen of the human body. Jaws flapped, arms waved, bodies waltzed drunkenly and strolled with each other, rubbery fingers entwined as couples lurched off to private corners.

"What . . . what are they doing?" I gasped.

Antarg looked immensely pleased. "Eating. Talking."

"What are they eating?"

Chuckling, he rattled off a lengthy list of foodstuffs. Steak and potato pancakes. Sundaes, raspberry tarts, and a litany of meat and dairy meals. Things stolen from other bodies.

Except in this case, the foods weren't real. Nothing was being stolen.

Except life, I thought. The lives of those creatures on Tempest.

Indrani finally piped up from the doorway. "Antarg? If Preema were to wear your visor, would she look like you to the guests?"

The Controlman didn't look away from me—I blushed under his hot stare. "Yes.

Everyone here can be anything they want, even me.”

Indrani nodded. “Borrowing someone’s karma. Interesting. Don’t you agree, Preema?” She looked expectantly at me, and I suddenly understood:

Karma opens the right path.

Antarag rubbed his chin thoughtfully. “As I recall, Preema, one of your sacred oaths is to always tell the truth.”

“To never tell a lie,” I corrected him, and I motioned for his own visor. “May I?”

He handed me the visor. “I’d like to ask you something, Preema. And I expect you to tell me the truth.”

“Yes?”

“Why did you come up here today? What’s the *real* reason you people stopped by for a visit?”

And just then, the security alarm went off.

VII.

Antarag Vel-Heth leaps up, cursing, wires trailing, and dashes down the hall to where the alarm was triggered. His pistol is in his hand, and I almost scream, thinking of Komal—my grandfather—in danger.

“Now’s your chance,” Indrani whispers, looking stricken. “Quickly, Preema!”

I affix the heavy visor to my face.

I become Antarag.

Not the real Antarag, of course, but his idealized avatar—the bulging, muscular specimen of crude masculinity from a high gravity planet. The plastic people are replaced once more by beautiful illusions.

When I speak through the headset microphone it is not my voice, nor his, but a gruff baritone from his preferred play-list:

“How are you enjoying yourselves?” I ask them.

The crowd barely hears me. Only the nearest man, Captain Jason Finch of Winter’s Tale according to the ID bubble floating near his head, stirs drunkenly, a glass of liquor in one hand and a sultry, supple female clinging to neck. “Everything’s great, Antarag, as usual.”

“Good.” I hesitate. “Ever visit the Bellcaps?”

He squints at me. “The Bellcaps?”

At this, the girl around his neck jerks to attention. “Oh yes! Let’s hear more gossip! I love that last story you told about Bellcap 17! How

can it be that none of them know Fenton is sleeping with Jezebel *and* Sinaga? I mean, they’re sisters! Don’t they ever talk?”

“I do not know,” I say truthfully. “Actually, I was wondering if there was any gossip about Bellcap 51?”

“You mean the freaks?” Captain Finch asks.

The woman’s eyes brighten. “Yes, the freaks of 51!” She laughs wickedly and grabs a fistful of grapes from a silver platter. I try not to think about her rubbery framework pawing at empty air.

Finch shrugs. “What about them? They’re like monks or something, aren’t they?”

My mind scrambles to respond. “Well . . . um . . . they are down there disposing of all that debris, and they, um, don’t even know what the debris is.”

I’m gambling, and my heart stops as I behold their puzzled expressions. I had been counting on the idea that *they* knew about the debris. Someone here must know!

“Antarag,” the captain starts, “What do you think they’d do if we told them? Pray hard in our direction?”

“Told them what?”

“About the jellies!” the woman shouts. “They talk about it on the bridge sometimes. Were they really *that* dangerous?”

Captain Finch strokes her hair absently. “It took fifty years and an entire armada to subdue them. So yeah, they were pretty fucking dangerous, Darlene.”

Treading carefully even as my stomach knots, I try a further prompt. “Did you see these jellies for yourself, Finch?”

He gives me a sharper, more perplexed look. “What are you talking about? Are you drunk? Truly drunk? You hoarding the real stuff down there in your prison?”

“I am not drunk.”

“Then you know perfectly well how we killed them together, my friend!”

“Oh,” I say, and then quickly, truthfully, add, “I’d like to hear you tell the story. I’m guessing Darlene would as well.”

He sits straighter in his chair, looking uncomfortable. “Antarag and I were part of the armada, Darlene. We didn’t have an armada at first. It started with exploratory ships dropping into orbit when we first got into this system. Those early captains must have shit themselves when they saw how many jellies were

floating in Tempest's atmosphere! There were millions! Huge, floating gasbags!"

"And you popped them!" the woman giggles. "Popped them like balloons!"

The man hesitates; the grim intensity on his face is no illusion, and I think about how the neurocast transmitter must be accurately portraying his real face from whichever ship his body is in. "No," he mutters, "Not as easy as popping balloons. When the first ships arrived, there was no fighting because those jellies were merely curious about us."

"They were intelligent?" I cry.

"Fucking brilliant. When they realized our intention was to take the planet's hydrogen, they began a systematic opposition. Started harassing the building crews. So we took to building in space, where the jellies couldn't get at us. But once we eased the Bellcaps into place, the jellies would dismantle them. Pried them apart at the seams and threw them down to the planetary surface." He motions for something more to drink.

I can't get him a new drink; I didn't have Antarag's holodisplay menu gauntlet.

"A drink!" Finch demands. "Antarag?"

Thinking fast, I lean forward and pluck a half-filled glass that is already on the table and hand it to him. He imbibes the clear fluid, makes a face. "You know I drink cognac! Get me some!"

"Finish the story," I say. "I really, really want to hear this. So does she."

"Yes," Darlene encourages, flinging another grape from her fist into the air and catching it with her teeth. "Didn't you tell me they shot lightning out of their bodies?"

"Plasma," the captain corrects her. "Bright, hot plasma that turned our equipment into fireworks and flaming wrecks. We tried all kinds of defensive measures. After some seventeen trillion tradenotes wasted on that shit, we petitioned the IPC Congress for an attack fleet to subdue the natives." He shakes his head in disgust. "Bunch of weak-kneed elitist philosophers! We needed the hydrogen! Do you have any idea how the economy would collapse without it? But the IPC was content to sit on their asses, whining about genocide. Genocide applies to people, not gasbags."

I can't help myself. The words blurt out of their own accord. "But they were intelligent, you said! Brilliant."

"Brilliant and deadly."

"How did you kill them off?"

Captain Finch is silent for a while. He's forgotten his request for cognac. "Had to go behind the IPC's back. Got together thirty mercenary ships, costly as hell. Then . . ." His eyes focus on some faraway point in space and memory.

"Then?" I prompt, feeling sick.

"Then we showed up in high orbit and started blasting the things to smithereens. Practically set the atmosphere on fire doing it."

Darlene applauds, grapes flying from her hands.

"I wasn't finished!" the captain's eyes are hard. "Even with all those ships, the gasbags put up a hell of a fight! They split up into roving bands and shot at us with plasma. Took down half our fleet! We had to park farther and farther out from Tempest, staying out of range. Practically had to squint to see what we were shooting at."

"But you cleared them out," Darlene says, confused by his anger. "So all was fine!"

"All was *not* fine! It took years to kill them all off, do you hear me? We started calling them the Cloud Kings, because 'jellies' didn't do justice to their cunning, their sense of purpose. A king defends his kingdom, right? And these things had a world to defend. When we finally cleared them out . . . there was debris. Pieces of them everywhere. And that's when we discovered those pieces could reunite. They would reconstitute with the memories of dozens of outraged predecessors. *And they remembered!* Remembered our tactics and weapons. . . . They started the fucking war all over, again, only now we had fewer ships, and the fucking IPC was setting up a local system of fice. We barely put the jellies down again. The bristles . . ." He nods, satisfied, though I imagine that his real body in its high-orbital ship is shivering and sweating as he relives the sweaty hell of old days. "The bristles *keep* them dead."

For a long moment he says nothing more. People get up and skip off to private corners for secret intimacies. Even Darlene soon tires of his silence, and she leaves for entertainment elsewhere.

Finally, Finch scowls at me. "You're an asshole, Antarag. You know I can't stand remembering those days. You think you're something

special, maneuvering yourself into this king-shit post, but look at you—You're a glorified maitre d'!" He stands and hurls his empty glass to the floor. Fragments shower our feet and instantly dissolve into pixels. At the same time, a replacement glass appears on the table, but by then Captain Finch has already vanished too, abandoning the party altogether like a discontented spirit fleeing newly consecrated land.

I'm sliding the visor off my face when crude hands wrestle me out of the chair.

VIII.

Controlman Vel-Heth stands me up and shoves me into the midst of Indrani and Komal. He waves the pistol with menace, his eyes clouded in a rage that seems entirely out of proportion to the alarm. Here's a man not used to being challenged or deceived, I think.

"What were you doing?" he demands of my grandfather. "Tell me straight: What were you doing in the storeroom, Komal?"

"Weapons are not necessary. We are pacifists. We will not fight you."

"Then answer me, old man."

Komal sighs in his beard. "I was distracting you," he says.

Antarag's eyes sharpen. "From what, you bastard?!"

Komal remains silent. The Controlman closes one eye and draws a bead on Komal's knee, and I crazily think: He'll never walk with grandmother again.

"Stop!" I cry. "Komal was distracting you from what I was doing."

Antarag nods vigorously. "I figured that much. What *were* you doing, you little bitch?"

"It was my idea to come up here, and that is the truth. I . . ."

I thought of all the creatures that had been murdered. A genocide over decades. An entire species driven into oblivion.

Controlman Vel-Heth roars, "Tell me!"

I stammer, looking guiltily to the plastic people. "I wanted to . . ." I look toward the plastic people with a pained expression. "You know." Silence has many uses.

Komal turns away in disgust and marches back towards the elevator. Indrani shakes her head sadly and mutters, "Oh Preema!"

But Antarag's eyes bulge in astonishment. A grin cracks his knobby face and he throws his head back with a hideous laugh.

"You wanted to *get your rocks off*?" he shouts in his high-pitched cackle. "The good little Jain girl wanted to sow some wild oats. Ha!"

I hang my head in shame. Not any shame that I feel. The shame that we all deserve, all those who participated—willingly or not—in the murder of an entire planet.

Antarag stomps around in a circle, laughing and holding his stomach with his pistol-hand. "Oh! You little lying whore. The perfect little people of the perfect little faith." He rushes over to me and grasps my shoulders. "Did you eat steak? Or was it a different kind of meat you wanted to put in you?"

Indrani cuts in and takes my hand. "We are done here," she snaps, leading me away from room, toward the elevator. I catch a glint of pride, not anger, in her eyes. She squeezes my hand in a rare allowance of emotion.

"Thank you, mother," I whisper.

"Thank *you*, daughter," she whispers back.

And from behind us, Antarag cries out, "You people made my day!"

Strange, I think, how utterly genuine he sounds as he says it. Even madmen can, from time to time, speak the truth.

IX.

Eight months pass.

Twelve more teams of Jains immigrate from Midsummer's Dream, replacing Bellcap teams who are only too happy to abandon their tedious, low-paying posts. Once they're settled in in their own Bellcaps, Komal pays them personal visits and explains what has been happening. He tells them of the genocide on Tempest. And they are only too happy, after hearing the tale, to deactivate the spire bristles.

The jellies—the Cloud Kings—have been growing and multiplying, as a result.

They are truly immense creatures, and yet I know it's unlikely they've attained the full girth of adulthood in only eight months. Already they are half as large as the Bellcap stations. They grow out of the debris, which continues to accumulate here in greater and greater numbers. Piece by piece, the ancient race is putting itself back together.

Intelligent? Yes indeed. Indrani and Parul devised a rudimentary system of communication involving pulses of colored light. The

ANALOG

Cloud Kings gather around the Bellcaps now like friendly balloons. They allow the airborne slugs to alight on them, as must have been the pattern long ago. They don't tell us much, but we have managed to convey our intentions. In return, they have expressed their thanks. They have promised not to hurt us.

Us.

As in, the ones who helped them. As in, the ones who stopped the genocide and allowed them to come back from the dead.

Now, I stand outside on the atmoprocessor spire with Komal and Indrani and Parul and Geeta, watching the Cloud Kings depart. They fill the sky above us like fiery halos ascending toward heaven.

"What triggered their flight?" I ask. "Where are they going?"

"They did not tell us," Komal mutters. "The ladar showed them moving off in an unexpected migration. We asked them what they were doing, but they did not respond."

My stomach knots, and I swallow down a welling of emotions I do not care to identify. "They have all changed to the same color," I observe as they ascend out of sight, converging like tiny fires on Lindorm Refueling Station. "They have been blue or green or violet for months. Now they are *all* red."

My grandfather nods. "The colors derive from their emotional state. Blue and green are closest to friendly curiosity. Violet appears to be a state of equanimity."

"And what are they feeling now?"

"Rage," my grandfather says, his voice tinny in my headset. "Every last one of them is filled with rage. . . ." ■

The other day I was shooing some young whippersnappers off my lawn (as one does), and they asked a question that deserves discussion: why should today's readers care about the history of science fiction?

After all, there's plenty of new stuff to read. It's been at least two generations since any one person could keep up with all the SF published in a given year. Younger readers struggle to keep up with current magazines (traditional or online), podcasts, video (tv, movies, and games), and books; why should they worry about older stuff?

Besides, older SF—particularly the classics—suffer from the linguistic style and social attitudes of their time. Younger readers find the SF of the past stilted and unexciting, and they chafe at the lack of human diversity and overuse of stereotypes. So why bother?

I have two answers, and which one I give depends on why one chooses to read SF to begin with.

Some SF readers are primarily after adventure and excitement, sense of wonder, and/or the experience of otherness that SF evokes so well. These readers can skip the older stuff without harm. Oh, we oldsters know all the gems they're missing—but they have enough gems to keep them happy.

Other SF readers are primarily in it for the ideas. These are the problem-solvers, the process-oriented folks. Most, if not all, *Analog* readers fall into this category. And to this kind of reader, a familiarity with what's come before is essential.

To these readers, SF is larger than any one book, author, or subgenre. SF is an exchange of ideas, a decades-long conversation of "what if?" in which authors respond to one another in ringing the changes on any number of concepts: politics, religion, the nature of identity and intelligence, free will vs. determinism, the meaning of life.

Today's readers join a conversation that's been in progress for (in some cases) a century or longer. For a reader interested in ideas, it's not enough to know how Ann Leckie portrays artificial intelligence in her Hugo-winning novel *Ancillary Justice* . . . one needs to know how Robert J. Sawyer did it, and Charles Stross, and Peter F. Hamilton, Chris Moriarty, Greg Egan, and Melissa Scott. Of course, their work was in response to the ideas of Vernor Vinge, Dan Simmons, Iain M. Banks, and William Gibson . . . who in turn were responding to the likes of Douglas Adams and David Gerrold, who responded to Robert A. Heinlein, Arthur C. Clarke, Jack Williamson, and Murray Leinster, who wrote in response to Isaac Asimov, Lester del Rey, and Eando Binder, who were inspired by Karel Capek and Mary Shelley . . . and so on. (In the name of simplicity, I've left out many more authors, as well as tv, movies, comics, and video games—all of which have said important things about A.I.)

To a process-oriented, idea-driven kind of reader, there are few things more satisfying than this multi-dimensional game of ideas.

Okay, granting that knowing something of the history of SF is a good thing, where can the current reader learn about that history?

A great place to start is an article titled "History of SF" in the *Science Fiction Encyclopedia* at www.sfencyclopedia.com. This well-researched site is highly browsable, with many links to cross-references that can keep one busy for hours.

There are dozens, if not hundreds, of books about the history of the field, most of them readily available. Two of my particular favorites are *The Trillion Year Spree* by Brian W. Aldiss (1986) and *The Visual Encyclopedia of Science Fiction* by Brian Ash (1983). You can find a fairly comprehensive bibliography of works about SF at Washington State University at public.wsu.edu/~brians/science_fiction/sfresearch.html—but be aware that this

bibliography hasn't been updated since 2008, and it only includes resources held by the WSU library.

In addition to histories of the field, there's a wealth of information, both online and in books, on the lives and work of individual authors. Fortunately, many of the departed giants of the field left us autobiographical works; scholars and other enthusiasts have produced everything from biographies to literary criticism of major authors.

And then there are the classics themselves, the SF books and stories written by these titans of the past. Next month, I'll talk about how to find the classics.

Meanwhile, here are some goodies for you.

Futures Past: 1926: The Birth of Modern Science Fiction

edited by Jim Emerson

sfhistory.net, 64 pages, \$6.00 (pdf e-book)

Series: Futures Past 1

Genre: Nonfiction

For those interested in the history of the SF field, *Futures Past* is a promising, ambitious new series. This is the first of a planned fifty quarterly volumes, each covering a year from 1926–1975. At the moment, the idea is to publish each full-color volume in pdf format at sfhistory.net; if there's enough interest, there's the possibility of hardcover publication in the future.

This short book is a labor of love, and it shows. The layouts are gorgeous, the information invaluable, and the coverage exhaustive. Whether you're a nostalgic old-timer or a brand-new reader, you're going to find lots here to enjoy.

The year 1926 is generally considered the beginning of modern science fiction; it's the year Hugo Gernsback first published *Amazing Stories*, the original SF magazine. This volume jumps right in with a facsimile of Gernsback's editorial on the first page of that first issue, and goes from there.

There are capsule biographies of important SF figures; insanely-detailed chronologies of events both within the field and outside; covers and contents of every issue of the important magazines; covers and descriptions of the SF books, films, and plays of 1926; essays on *Weird Tales* magazine, Gernsback and

Amazing, and author Murray Leinster; and a page of annotated resources. Three of the essays are excerpts from books by SF historians Mike Ashley, John L. Coker III, and Bud Webster.

Scattered through all this are scores of pictures, including full-color magazine and books covers.

For six bucks (less than the inflation-adjusted cost of two issues of *Amazing Stories* in 1926) this book is a must for any reader curious about the long-ago beginnings of our field. Until real time travel comes along, this is as close as most of us can come to experiencing those halcyon days.

If sfhistory.net can keep up their project, *Futures Past* promises to be a vital reference on the history of SF, a gift to the future.

Harry Harrison, Harry Harrison!

Harry Harrison

Tor, 352 pages, \$26.99 (hardcover)

Kindle: \$11.04, Nook: \$12.99 (e-book)

ISBN: 978-0-7653-3308-7

Genre: Nonfiction

The late Harry Harrison was no stranger to these pages. Although best known for his humorous Stainless Steel Rat series (*The Stainless Steel Rat*, 1961, and sequels), he also wrote popular SF adventure (such as *Deathworld*, 1960, and sequels) as well as highly-regarded serious work like the Eden trilogy (*West of Eden*, 1984, and sequels) and the Hammer and the Cross trilogy (*The Hammer and the Cross*, 1993, and sequels). His near-future SF book *Make Room! Make Room!* (1966) was adapted into the 1973 movie *Soylent Green*. In 2009 the Science Fiction Writers of America awarded Harrison their Grand Master award.

When Harrison passed away in August 2012, he was still working on this autobiography. His daughter Moira was instrumental in bringing the finished book to publication. We owe her a great debt for her efforts, for our world would be poorer without this book.

Harry Harrison was the kind of author who could make even a shopping list compelling. But he led a life a lot more interesting than a shopping list, and his autobiography is as hard to put down as any of his adventure stories.

A science fiction fan from the very beginning (he was a charter member of the Queens Science Fiction League in 1938), Harrison was an illustrator, writer, and editor in comic books and pulp magazines before he became a full-time SF writer. He wrote newspaper comic strips, including a decade-long run on *Flash Gordon*. With Brian Aldiss he edited an annual *Year's Best SF* series from 1968-1976.

A prominent figure in the Esperanto community, Harrison was an internationalist. He and his family lived all over the world: Mexico, England, Italy, Denmark, and Ireland as well as various locations in the United States. He was a founding member of the organization World SF. He attended international SF conventions and gatherings (many of which he also helped organize) everywhere from Brazil to Russia.

Harrison tells the fascinating story of his life with honesty and humor, and keeps returning to his theme (also the book's subtitle): "It seemed like a good idea at the time." From the perspective of a true world citizen, he reminds us that SF transcends nation, language, and culture. Like many of the giants of our field, Harrison's life *was* the history of science fiction.

Above all else, Harry Harrison's life was fun . . . and this book conveys every fun moment along the way. Definitely recommended.

Handbook of Vance Space

Michael Andre-Driussi

Sirius, 216 pages, \$32.95 (hardcover), \$16.95 (paperback)

ISBN: 978-0-9642795-6-8 (hc), 978-0-9642795-7-5 (pb)

Genre: Nonfiction

Yes, the title makes it sound like a particularly obscure mathematics textbook. Instead, it's an encyclopedia-style reference to the science fiction of Jack Vance.

Vance, who died in May 2013, was another of the greats of the field. Multiple Hugo Award winner, he was named SFWA Grand Master in 1997. In science fiction, he was particularly known for *Big Planet* (1957), *The Dragon Masters* (1963), and the Demon Princes series (*The Star King*, 1964, and sequels). He was equally accomplished in fantasy (the Dying Earth series and the Lyonesse trilogy) and in the mystery field.

The major section of the *Handbook of Vance Space* is an encyclopedia-style listing of planets, stars, space stations, nations, and other entities in Vance's SF. Appendices cover everything from star maps and chronologies to the details of sports and phases of the moons of the world Marune.

This book is (hugely) expanded from a 1997 chapbook called *Vance Space*.

If you're a fan of Vance, you need this book. If you've never read Vance, or are just a casual reader, it's still fascinating. And don't worry about spoilers: the author has concealed "sensitive information" behind a simple cipher so they can't spoil a story by accident.

Channel 37: Season One!

Paul Lagasse and Gary Lester

Greyrock, 314 pages, \$14.95 (paperback)

ISBN: 978-0-9816118-2-2

Genre: Short Fiction Collections

Back in the April 2012 issue, I talked about the website *channel-37.net*, where Paul Lagasse and Gary Lester posted short stories inspired by the kind of late-night SF movies that were featured on UHF TV channels of the 1950s through 1970s.

Now the fruits of their labor are collected between covers as *Channel 37: Season One*, a collection that pays homage both to late-night tv and to the old pulp SF stories of the early days.

Here are complete serials such as "The Terror From the Other Dimension!" and "They Came From New Jersey!"—complete with hilarious fictional details of the "films" and the "studios" that supposedly issued them. Here's space opera "Space Repairman," which "began as a replacement series for a Saturday morning children's puppet show called *Playtime With Mister Cat and His Furry Friends* on station XHFD in Hartford, Connecticut" before becoming a world-wide television sensation.

Written with tongues firmly in cheek, this book should be read the same way. The reward is adventure, fun, and a dash of old-fashioned sense of wonder.

Red Tide

Larry Niven, Brad R. Torgersen, and Matthew J. Harrington

Phoenix Pick, 212 pages, \$14.99 (paperback)

Kindle: \$6.99, Nook: \$12.99 (e-book)
ISBN: 978-0-61242-132-2
Series: Stellar Guild, Flash Crowd
Genre: Teleportation

One of the topics in the ongoing conversation of SF is teleportation. Back in the 1970s, Larry Niven rang the changes on the concept in his Flash Crowd series of short fiction (beginning with “Flash Crowd,” 1973) and even a nonfiction article (“The Theory and Practice of Teleportation,” 1969). Now he’s back again, along with two partners, for more stories on the topic.

The gimmick behind Phoenix Pick’s Stellar Guild series (edited by Mike Resnick) is pairing a novelette by an established writer with a companion piece by a newer name. In this case, there are two junior authors: Brad R. Torgersen and Matthew J. Harrington. In addition, Niven rewrote the original “Flash Crowd” into the title piece, “Red Tide,” as well as a new short story.

As you’d expect, Niven’s teleportation is nuts-and-bolts technology, consistent with the laws of physics (including kinetic energy and conservation of momentum). But technology alone doesn’t make a story, and these tales are all about the impact of teleportation on individuals and society.

“Red Tide” sets the stage with news reporter Jerryberry Jansen’s pursuit of a new social phenomenon, the flash crowd: instant mobs in which hundreds or thousands of people worldwide converge on any event appearing in the news. Niven’s second story, “Dial at Random,” deals with Hilary Firestone, a teenager with a defective teleportation pass that allows her to materialize at any random destination, even those protected by heavy security. When she gets into the experimental teleport network of the JumpShift corporation, the fun really begins. . . .

Torgersen’s “Sparky the Dog” is a story from the early days of JumpShift, a tale of industrial espionage, betrayal, and a brave canine. And Harrington’s “Displacement Activity” is a brilliant demonstration of how teleportation links garbage disposal with space exploration.

Four stories, all thoughtful and entertaining, all playing with one of the most fascinating and dramatic concepts in SF—what’s not to like?

Hieroglyph: Stories & Visions for a Better Future
edited by Ed Finn and Kathryn Cramer
William Morrow, 532 pages, \$27.99 (hardcover)
Kindle: \$14.44, iBooks, Nook: \$16.99 (e-book)
ISBN: 978-0-06-220469-1
Genre: Original Anthology

From the very beginning, science fiction has been about inspiring innovation. In that very first issue of *Amazing Stories*, Hugo Gernsback said, “. . . the best of these modern writers of scientifiction have the knack of imparting knowledge, and even inspiration, without once making us aware that we are being taught.”

This spirit lives on in Neal Stephenson’s Project Hieroglyph, headquartered at Arizona State University’s Center for Science and the Imagination. In a 2011 essay called “Innovation Starvation” (reprinted in this volume), Stephenson talked about SF’s power to provide concrete illustrations of compelling innovations; like hieroglyphs, SF stories provide easily-grasped symbols for complex technological and social concepts.

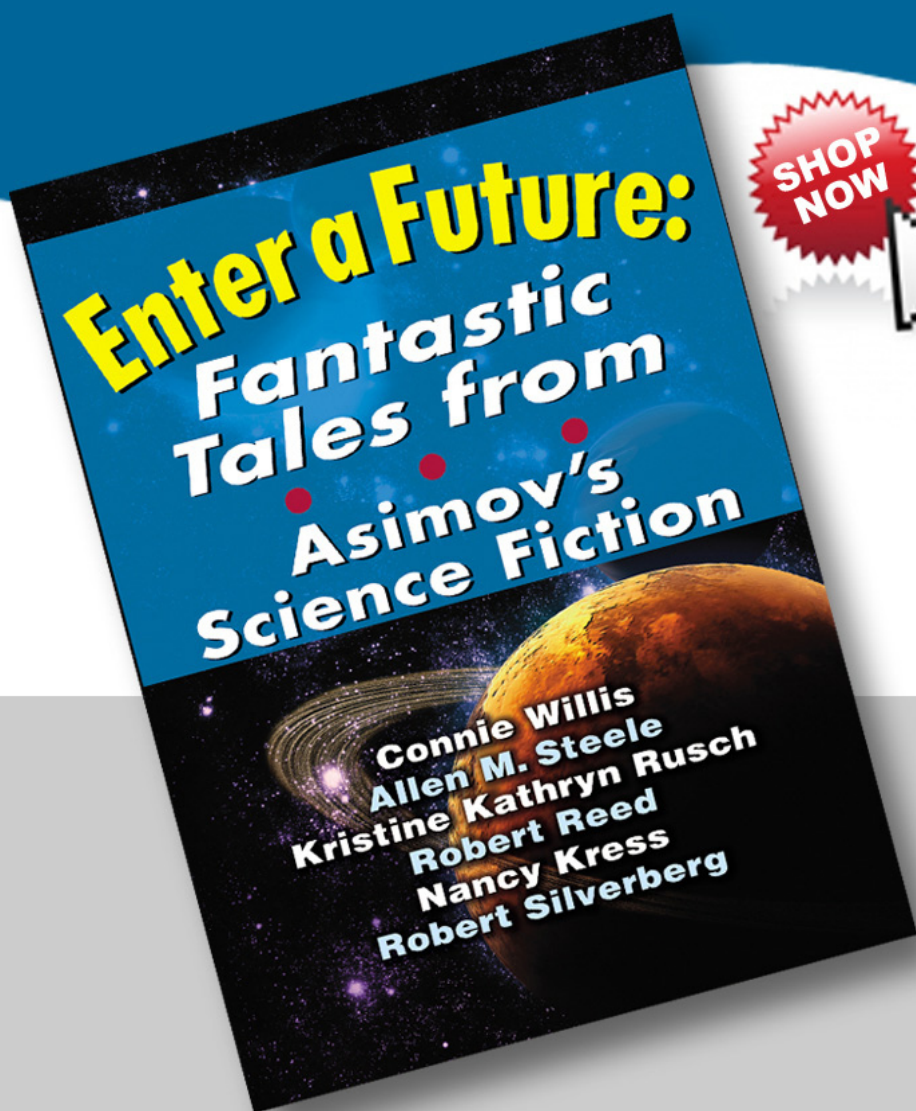
This anthology presents a dozen and a half stories by the likes of Stephenson, Gregory Benford, David Brin, Cory Doctorow, Geoffrey A. Landis, Karl Schroeder, Bruce Sterling, and many others. Topics range from Lunar colonization to urban engineering. But the fiction is only half the content: the stories are supported with commentary, technical articles, and speculations by multiple contributors. Most of this additional content isn’t actually in the book: it appears on the Project Hieroglyph website. Links in the book point the way to individual articles.

If you read SF for speculation about technological and social innovation—and if you’re reading *Analog*, it’s a fair bet you do—this anthology and the associated website will give you plenty of reward.

And now I’m out of space—so like the early days of SF, I’m history. Until next time, enjoy. ■

Don Sakers is the author of *Children of the Eighth Day* and *Meat and Machine*. For more information, visit www.scatteredworlds.com.

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BRASS TACKS

Hi,
For no apparent reason I thought of you guys today, and I wondered if you were still around. I subscribed when I was about 14 years old and kept the subscription on and off for probably ten years or so until I graduated from college as a mechanical engineer. I'm 64 now.

So I punch you into Google and there you are and I had to smile at that. I still remember the thick, small-format, odd-sized paperbacks and I enjoyed reading them.

Good for you guys and well done. It is a legacy worth keeping alive.

Steve Johnson

Dear *Analog*,

David Brin's "Chrysalis" [October 2014] is the best story in *Analog* in a long time. Possibly his best work.

Almost every paragraph adds to the scientific foundation of the story and moves it along smartly. The twist at the end really added to the interesting possibilities of the story.

Harold Parks
Minden, NV

Mr. Quachri:

Just a note of thanks for including "Chrysalis" in your October 2014 issue of *Analog*. I found it both original and thought-provoking.

A couple of the thoughts which came to my mind:

I can only imagine, having just finished *Earth Awakens*, the latest in the Ender series by Orson Scott Card, what Mr. Card could do with the concept. Legalities aside, what if the Formics were found to be the "adult" stage of a humanity that we never got to because that process got turned off genetically, here, way back when? Just a thought...

I also wondered if anyone has ever done a gene sequence of a caterpillar and its moth? (And maybe its pupa stage as well.) Unlike mammals, fish, birds, etc., the caterpillar and moth appear to be completely different creatures, not variations on a common one. During the pupa stage, is the genetic sequence fundamentally altered? It would seem necessary, given the transformation. Under-

standing how such a wholesale alteration could be accommodated within the animal's genetic code would be fascinating. (Not that how anything done within the code isn't, of course.)

Anyway: Thanks again.

Jim Hall
Colchester, CT

Quite a few butterflies and moths have had their genomes sequenced. In fact, researchers can head to www.butterflygenome.org to browse the genomes of the forty or so species in the Heliconius genus of butterfly alone.

Very simply, the genetic instructions that "make" both caterpillar and butterfly or moth are present at all of the animal's life stages, but only one set of those instructions are expressed at a time.

Donald Williamson at the University of Liverpool has put forth the theory that the adult form of the animal is actually a completely new organism, one of two mated but genetically unintegrated creatures from the distant past. To say the theory has been pretty thoroughly rebutted is putting it lightly; it has helped inform some good science fiction, like "Chrysalis," though.

Dear Trevor:

I have been a subscriber since the late 50s and have a complete collection of *ASF* starting with the August 1948 issue. In all those issues, I don't remember seeing such a perfect match as Richard A. Lovett's guest editorial "IndigNation" and the letter from Ron Gould in the October 2014 issue. This screed perfectly illustrates Mr. Lovett's point! Personally, I lean quite "rightwards," but wasn't at all offended by the "Determined Spirits" story, and thought it was at least as well written as the majority of stories we get these days, and better than many. (I'm still partial to the "Thud and Blunder" type of story, I must admit.)

In any case, I think you are doing a fine job as editor. It can't be easy trying to satisfy the thousands of subscribers who know how to do the job so much better than you do!

Here's wishing you many more happy years as editor of my favorite SF magazine!

Bob Hubbard
Winter Haven, FL

Dear Editors,

October issue with the Schmidts ["Opportunity Knocks," October 2014]. More, MORE. They are really fun, please encourage more more . . .

Jim Eagle

Dear Friend:

I always find articles like Edward M. Lerner's "Alien AWOLs: The Great Silence" (*Analog*, October 2014) to be fascinating. But I always wonder, what else should we expect?

Are we the only intelligent race in the Universe? We aren't even the only intelligent race on Earth. Dolphins and their relatives and crows and some other birds are just some of Earth's intelligent passengers. True, we humans are the only ones with the language and dexterity to create a technological civilization. But that's something different from "intelligence."

Why haven't we heard from other technological civilizations, or at least eavesdropped on them? SETI programs hope to detect electromagnetic signals. This has always seemed a little foolish to me. These travel only at the speed of light. Although this is pretty fast, the distances between planets in our Solar System makes real-time communication from Earth for control of space probes out at Mars, Jupiter, or Saturn impractical. I can only wonder if the adjective "intelligent" would be appropriate for races (our own included) who think that communication with their neighbors over distances requiring years, perhaps hundreds or thousands of years, for a reply is practical.

Well, if two-way communication is out of the question, how about just sending out a "Here we are!" message? (Considering what has happened every time European "aliens" contacted aboriginal cultures around the world, perhaps this is also not such an intelligent idea.) In the January 2012 issue of *Sky & Telescope* magazine, Joseph Lazio describes a variety of ways to send signals between stars. He also discusses the vast amounts of energy required for any of these methods. Why would any "intelligent" race waste such immense amounts of energy on such a silly, perhaps risky, mission? They probably wouldn't.

Another way to detect alien civilizations would be to listen for their radio and TV broadcasts (eavesdrop). A sidebar to the *Sky & Telescope* article asked the question, "Could aliens listen to

our radio or watch our TV?" But it left out the answer to one important question: "If the alien civilization was technologically similar to ours, how close would they have to be to detect our signals (or, from the point of view of SETI, we, theirs)?" I queried *Sky & Telescope* and my question was answered in their April 2012 issue. According to Dr. Lazio, "we could only detect ourselves slightly outside the Solar System and certainly not farther than about 1,000 a.u. [astronomical units]." For reference, Dr. Lazio pointed out that the Alpha Centauri star system, our closest stellar neighbor, is about 300,000 a.u. away.

Why haven't they visited us? Considering the number of UFO reports that have not been classified as due to swamp gas, the planet Venus, hoaxes, etc., and the reports of strange beings in the various mythologies of terrestrial cultures, perhaps Fermi's question should have been "Why didn't they stick around?" Perhaps they did. But would you want to visit folks whose main method of settling disagreements is to use deadly force?

We should not be surprised if it seems that we are alone.

Jack Ryan

Editors,

In the November issue, the story "Flow" by Arlan Andrews, Sr. generated the thought that this is a continuation of another story I read in *Analog* six months to a year ago. Nowhere is a mention of "Flow" being part 2 of a story or being associated with any other story. Every time a story or the characters in a story are associated with a previous story you put a note about it at the end. Therefore I assume my mind is messing with me. That is why I am contacting you. I see too many similarities between "Flow" and the story I read. In fact, if I had not read this other story, some of "Flow" just would not have worked as well as it does. Is "Flow" a continuation or a part 2 of another story? If so, what is the name of the story and what issue of *Analog* was it in? If I am right, then you might put a note out in a future *Analog* to let others know of the connection.

Randolph J. Shine
Deerfield Beach, FL

No, your mind (probably) isn't messing with you. We just done goofed and left off the editor's note letting readers know that "Flow" is a sequel to "Thaw" (July/August 2013). ■

UPCOMING EVENTS Anthony Lewis

NOTE: Membership rates and other details often change after we have gone to press. Check the websites for the most recent information.

12–15 March 2015

OPERAICON (get together celebrating the world premiere of the new Sucharitkul opera *The Snow Dragon*) at Hilton Milwaukee Center, Milwaukee, WI. Guest of Honor: Somtow Sucharitkul (aka S. P. Somtow). Memberships through 1 November 2014: Full attending \$90, attending but no opera \$50, supporting \$25. Prices will be more after that date. Full attending includes opera seats plus transportation to the theatre. Info: <http://www.fijagdh.com/operacon/>; Operacon, 2337 North Lefebvre Avenue, Milwaukee WI 53212 (make checks payable to Richard Smith).

20–22 March 2015

MIDSOUTHCON 33 (Mid South SF conference) at Memphis Hilton, Memphis TN. Author Guest of Honor: Cory Doctorow; Artist Guest of Honor: Melissa Gay; Gaming Guest of Honor: Shane Hensley; Science Guest of Honor: Ethan Siegel; Comic Guest of Honor: Eric Van Sciver; Costume/Media Guest of Honor: Dragon Dronet; Editor Guest of Honor: Elizabeth Donald; TM: Frank Tuttle. Membership: Adult (13+) \$40; Child (6–12) \$20; Kid (under 5) Free. Info: <http://www.midsouthcon.org/>; info@midsouthcon.org; MidSouthCon, P.O. Box 17724, Memphis, TN 38187-0724.

26–29 March 2015

AGGIECON 46 (Texas A&M conference) at Hilton Hotel and Conference Center, College Station, TX. At the door memberships: Full adult \$40; Full student (18+) \$25; Full student (13–17) \$25; Child (under 12) \$15; Day (Fri|Sat) \$20; Day (Sun) \$15. Info: <http://stuorg-sites.tamu.edu/~cephheid/>

3–6 April 2015

DYSPROSIUM/EASTERCON 2015 (66th British National SF Convention) at The Park Inn, Heathrow, London, UK. Guests of Honor: Jim Butcher, Seanan McGuire, Herr Doktor, Carline Mullan. Special Guest: Tanith Lee. Memberships until 31 January (until 3 April 2015): Adult attending £70.00 (£80); Adult supporting £25 (£25); Junior (12–17) £25 (£25); Child (6–11) £15 (£15); Infant (0–5) £5 (£5); Apocryphal £1 (£1). Info: <http://www.dysprosium.org.uk/enquiries@dysprosium.org.uk>

19–23 August 2015

SASQUAN (73rd World Science Fiction Convention) at Spokane Convention Center, Spokane, WA. Guests of Honor: Brad Foster, David Gerrold, Vonda N. McIntyre, Tom Smith, Leslie Turek. Membership: currently. Attending: Adult \$170; Young adult (17–21) \$90; Child (6–16) \$70; \$40. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Nominate and vote for the Hugos. Info: sasquan.org/; info@sasquan.org; 15127 Main Street East, Suite 104, PMB 208, Sumner WA 98390.

Running a convention? If your convention has a telephone or fax number, e-mail address, or web page, please let us know so that we can publish this information. We must have your information in hand SIX months before the date of your convention.

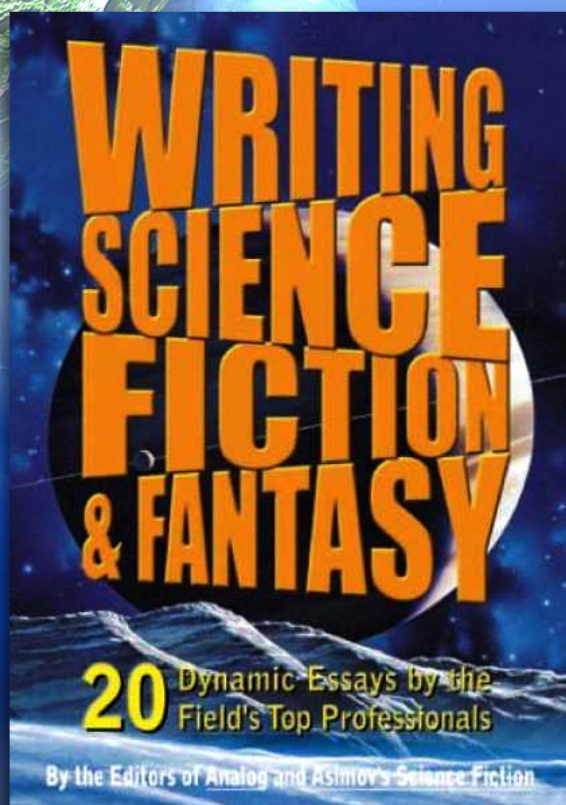
Attending a convention? When calling conventions for information, do not call collect and do not call too late in the evening. It is best to include a S.A.S.E. when requesting information; include an International Reply Coupon if the convention is in a different country. ■

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